# PHASE I DRAINAGE REPORT
# FOR
# *THE CANYONS PLANNED DEVELOPMENT 2nd AMENDMENT*
# *CITY OF CASTLE PINES*
# *DOUGLAS COUNTY, COLORADO*

***PROJECT NO. 14-002-017***

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# TABLE OF CONTENTS

I - GENERAL LOCATION AND DESCRIPTION ..... 3
A. Site Location ..... 3
B. Description of Property ..... 3
II - DRAINAGE BASINS AND SUB-BASINS ..... 4
A. Major Drainage Basins ..... 4
B. Minor Drainage Basins ..... 4
III – EXISTING STORMWATER CONVEYANCE OR STOARGE FACILITIES ..... 9
A. Existing Stormwater Conveyance Facilities ..... 9
B. Existing Stormwater Storage Facilities ..... 9
IV – PROPOSED STORMWATER CONVEYANCE OR STOARGE FACILITES ..... 9
A. Proposed Stormwater Conveyance Facilities ..... 9
B. Proposed Stormwater Storage Facilities ..... 10
V. WATER QUALITY ENHANCEMENT BEST MANAGEMENT PRACTICES ..... 10
A. Non-structural Best Management Practices ..... 10
B. Structural Best Management Practices ..... 10
VI – FLOODPLAIN MODIFICATIONS ..... 11
A. Major Drainageway – Undesignated Floodplain ..... 11
B. Major Drainageway – Designated Floodplain ..... 11
VII. POTENTIAL PERMITTING REQUIREMENTS ..... 11
REFERENCES ..... 12

## Appendix A

VICINITY MAP
FIRM MAP 08035C0177G
FIRM MAP 08035C0180F
FIRM MAP 08035C0187G
FIRM MAP 08035C0186G
SOILS CLASSIFICATION MAP
HYDROLOGIC SOIL GROUP MAP
EXCERPTS

- Phase I Drainage Report for The Canyons – Nolte Associates, Inc. (2009)

OVERALL DRAINAGE MAP
DETAILED DRAINAGE MAPS

# I - GENERAL LOCATION AND DESCRIPTION

## Introduction and Executive Summary

The Canyons Planned Development (PD) Amendment No. 2 generally conforms to the previously approved Canyons Planned Development, associated *Phase I Drainage Report for The Canyons prepared by Nolte Associates, dated June 2009*. This Amendment will not modify the previously approved development locations and Planning Areas. This amendment is limited to an increase in residential density within the project. Drainage patterns, detention pond locations, and development runoff will all remain consistent with the previous concept and design.

## A. Site Location

This Phase I Drainage Report provides a preliminary design for Lot 3 of *The Canyons Superblock Plat No. 1,* which generally includes Planning Areas (PA)10, 12, 13, 14, 15, 16, 17, 18, and 19 of The Canyons PD that encompass the 2nd Amendment of the previously approved 2009 Canyons PD. These PAs are located on the southern and eastern portions of the PD. The site is bound by Reuter-Hess Reservoir (Parker Water and Sanitation District) to the north, Happy Canyon Ranches and the portion of The Canyons currently under development by Shea Homes to the west, Sapphire Pointe Subdivision (Town of Castle Rock) and The Canyons South Subdivision to the south, and Castle Park Ranch Subdivision to the east. The site is located in a portion of Sections 1, 12, 13, and 24, Township 7 South, Range 67 West of the 6th Principal Meridian, City of Castle Pines, Colorado. A vicinity map for the site is provided in Appendix A.

## B. Description of Property

PAs 10, 12, 13, 14, 15, 16, 17, 18, and 19 are currently undeveloped land with slopes naturally ranging from 2% to 40% covered in native vegetation and Scrub Oak on 240.0, 120.0, 251.6, 192.0, 36.4, 34.9, 28.8, 22.9 and 30.7 +/- acres, respectively. These sites will generally consist of single-family residential, open space, a potential High School, and a small Mixed-Use area consisting of commercial development, townhomes, and multi-family residential. A portion of the site ultimately drains to Rueter-Hess Reservoir via South Newlin Gulch and a portion of the site drains to Lemon Gulch and its uppermost tributaries to the east. The site generally falls within Zone X as shown on the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) panels 08035C0177G, 08035C0180F, 08035C0187G, and 08035C0186G. Panels 08035C0180F and 08035C0187G show portions of the site fall within Zone A limits. Copies of the FIRM maps are provided in Appendix A.

The soils vary throughout the sites and include Fondis Clay Loam (FoD), Fondis-Kulch association (Fu), and Hilly Gravelly Land (Hg). The soil types are a part of Type C and D hydrologic soil groups. Soils maps are provided in Appendix A.

# II - DRAINAGE BASINS AND SUB-BASINS

## A. Major Drainage Basins

Historically, runoff within these parcels is conveyed into the existing drainage ways and channels with the South Newlin Gulch and Lemon Gulch Basins. The proposed basin delineation shown in this report reflect the current site plans and the existing topography of the site. The basin drainage patterns will generally follow the historic patterns which were previously identified in the *Phase I Drainage Report for The Canyons prepared by Nolte Associates, dated June 2009* (see Appendix A). The site lies within the South Newlin Gulch and Lemon Gulch Basins. Newlin Gulch is drains to the north into the Reuter-Hess Reservoir and Lemon Gulch drains to the east. Both drain into Cherry Creek, and ultimately becoming a part of the South Platte River.

## B. Minor Drainage Basins

The proposed drainage basins delineated within this report generally reflect historical drainage patterns with minor rerouting for roadways. Detention Ponds, both existing and proposed, are placed to control discharge into existing channels at historic, or below historic, rates to comply with water quality requirements of the City of Castle Pines, Douglas County, and the Cherry Creek Basin Authority. Offsite flows will be conveyed through the existing channels, storm sewer, and swales to avoid conflicts with the proposed development.

The Drainage Map included in the Appendix show sub-basin boundaries and acreages. The proposed basins are described as below:

Basin 1 (38.16 acres)

Consists of open space and residential. Undeveloped flows will be conveyed through sheet flow and natural channels to the east to Lemon Gulch Tributary. Developed flows will be captured by proposed storm sewer and routed to proposed pond 1. Proposed stormwater facility design to be provided in future Phase III Drainage Report.

Basin 3 (25.66 acres)

Consists of open space and residential. Undeveloped flows will be conveyed through sheet flow and natural channels to the east to Lemon Gulch Tributary. Developed flows will be captured by proposed storm sewer and routed to proposed pond 4. Proposed stormwater facility design to be provided in future Phase III Drainage Report.

Basin 4 (19.68 acres)

Consists of open space and residential. Undeveloped flows will be conveyed through sheet flow and natural channels to the east to Lemon Gulch Tributary. Developed flows will be captured by proposed storm sewer and routed to proposed pond 2. Proposed stormwater facility design to be provided in future Phase III Drainage Report.

Basin 5 (74.66 acres)

Consists of open space and residential. Undeveloped flows will be conveyed through sheet flow and natural channels to the east to Lemon Gulch Tributary. Developed flows will be captured by proposed storm sewer and routed to proposed pond 3. Proposed stormwater facility design to be provided in future Phase III Drainage Report.

Basin 6 (33.30 acres)

Consists of open space and residential. Undeveloped flows will be conveyed through sheet flow and natural channels to the east to Lemon Gulch Tributary. Developed flows will be captured by proposed storm sewer and routed to proposed pond 4. Proposed stormwater facility design to be provided in future Phase III Drainage Report.

Basin 7 (18.60 acres)

Consists of open space and residential. Undeveloped flows will be conveyed through sheet flow and natural channels to the east to Lemon Gulch Tributary. Developed flows will be captured by proposed storm sewer and routed to proposed pond 5. Proposed stormwater facility design to be provided in future Phase III Drainage Report.

Basin 8 (10.99 acres)

Consists of open space and residential. Undeveloped flows will be conveyed through sheet flow and natural channels to the east to Lemon Gulch. Developed flows will be captured by proposed storm sewer and routed to proposed pond 3. Proposed stormwater facility design to be provided in future Phase III Drainage Report.

Basin 9 (33.20 acres)

Consists of open space and residential. Undeveloped flows will be conveyed through sheet flow and natural channels to the east to Lemon Gulch.

Basin 10 (46.51 acres)

Consists of open space and residential. Undeveloped flows will be conveyed through sheet flow and natural channels to the east to Lemon Gulch. Developed flows will be captured by proposed storm sewer and routed to proposed pond 3. Proposed stormwater facility design to be provided in future Phase III Drainage Report.

Basin 11 (34.04 acres)

Consists of open space and residential. Undeveloped flows will be conveyed through sheet flow and natural channels to the east to Lemon Gulch. Developed flows will be captured by proposed storm sewer and routed to proposed pond 3. Proposed stormwater facility design to be provided in future Phase III Drainage Report.

Basin 12 (55.88 acres)

Consists of residential and residential rural. Undeveloped flows will be conveyed through sheet flow and natural channels to the east to Lemon Gulch Tributary. Developed flows will be captured by proposed storm sewer and routed to proposed pond 6. Proposed stormwater facility design to be provided in future Phase III Drainage Report.

Basin 13 (46.88 acres)

Consists of open space and residential. Undeveloped flows will be conveyed through sheet flow and natural channels to the east to Lemon Gulch Tributary. Developed flows will be captured by proposed storm sewer and routed to proposed pond 6. Proposed stormwater facility design to be provided in future Phase III Drainage Report.

Basin 14 (46.04 acres)

Consists of open space and residential. Undeveloped flows will be conveyed through sheet flow and natural channels to the east to Lemon Gulch Tributary. Developed flows will be captured by proposed storm sewer and routed to proposed pond 7. Proposed stormwater facility design to be provided in future Phase III Drainage Report.

Basin 15 (49.02 acres)

Consists of open space and residential. Undeveloped flows will be conveyed through sheet flow and natural channels to the east to Lemon Gulch Tributary. Developed flows will be captured by proposed storm sewer and routed to proposed pond 7. Proposed stormwater facility design to be provided in future Phase III Drainage Report.

Basin 16 (24.31 acres)

Consists of residential rural. Undeveloped flows will be conveyed through sheet flow and natural channels to the east. Developed flows will be captured by proposed storm sewer and routed to proposed pond 8. Proposed stormwater facility design to be provided in future Phase III Drainage Report.

Basin 17 (46.67 acres)

Consists of open space and residential. Undeveloped flows will be conveyed through sheet flow and natural channels to the east. Developed flows will be captured by proposed storm sewer and routed to proposed pond 8. Proposed stormwater facility design to be provided in future Phase III Drainage Report.

Basin 18 (41.24 acres)

Consists of residential. Undeveloped flows will be conveyed through sheet flow and natural channels to the east. Developed flows will be captured by proposed storm sewer and routed to proposed pond 9. Proposed stormwater facility design to be provided in future Phase III Drainage Report.

Basin 19 (29.79 acres)

Consists of open space and residential. Undeveloped flows will be conveyed through sheet flow and natural channels to the east. Developed flows will be captured by proposed storm sewer and routed to proposed ponds 10 and 11. Proposed stormwater facility design to be provided in future Phase III Drainage Report.

Basin 20 (119.73 acres)

Consists of open space and residential. Undeveloped flows will be conveyed through sheet flow and natural channels to the east. Developed flows will be captured by proposed storm sewer and routed to proposed pond 11. Proposed stormwater facility design to be provided in future Phase III Drainage Report.

Basin 21 (62.05 acres)

Consists of residential rural. Undeveloped flows will be conveyed through sheet flow and natural channels to the east. Developed flows will be captured by proposed storm sewer and routed to proposed pond 12. Proposed stormwater facility design to be provided in future Phase III Drainage Report.

Basin 22 (81.44 acres)

Consists of open space and residential. Undeveloped flows will be conveyed through sheet flow and natural channels to South Newlin Gulch where they ultimately drain to Reuter-Hess Reservoir. Developed flows will be captured by proposed storm sewer and routed to proposed pond 12. Proposed stormwater facility design to be provided in future Phase III Drainage Report.

Basin 23 (44.18 acres)

Consists of open space and residential. Undeveloped flows will be conveyed through sheet flow and natural channels to South Newlin Gulch where they ultimately drain to Reuter-Hess Reservoir. Developed flows will be captured by proposed storm sewer and routed to proposed pond 13. Proposed stormwater facility design to be provided in future Phase III Drainage Report.

Basin 24 (31.15 acres)

Consists of open space and residential. Undeveloped flows will be conveyed through sheet flow and natural channels to the east. Developed flows will be captured by proposed storm sewer and routed to proposed pond 15. Proposed stormwater facility design to be provided in future Phase III Drainage Report.

Basin 25 (22.92 acres)

Consists of open space and residential. Undeveloped flows will be conveyed through sheet flow and natural channels to South Newlin Gulch where they ultimately drain to Reuter-Hess Reservoir. Developed flows will be captured by proposed storm sewer and routed to proposed pond 14. Proposed stormwater facility design to be provided in future Phase III Drainage Report.

Basin 26 (17.69 acres)

Consists of open space and residential. Undeveloped flows will be conveyed through sheet flow and natural channels to the east. Developed flows will be captured by proposed storm sewer and routed to proposed pond 16. Proposed stormwater facility design to be provided in future Phase III Drainage Report.

Basin 27A (7.89 acres)

Consists of open space and residential. Undeveloped flows will be conveyed through sheet flow and natural channels to South Newlin Gulch where they ultimately drain to Reuter-Hess Reservoir. Developed flows will be captured by proposed storm sewer and routed to proposed pond 13. Proposed stormwater facility design to be provided in future Phase III Drainage Report.

Basin 27B (41.82 acres)

Consists of open space, residential, and residential rural. Undeveloped flows will be conveyed through sheet flow and natural channels to South Newlin Gulch where they ultimately drain to Reuter-Hess Reservoir. Developed flows will be captured by proposed storm sewer and routed to proposed pond 38. Proposed stormwater facility design to be provided in future Phase III Drainage Report.

Basin 27C (11.89 acres)

Consists of open space and residential rural. Undeveloped flows will be conveyed through sheet flow and natural channels to South Newlin Gulch where they ultimately drain to Reuter-Hess Reservoir. Developed flows will be captured by proposed storm sewer and routed to proposed pond 17. Proposed stormwater facility design to be provided in future Phase III Drainage Report.

Basin 28 (277.04 acres)

Consists of open space and residential. Undeveloped flows will be conveyed through sheet flow and natural channels to Big Windmill Tributary where they ultimately drain to Reuter-Hess Reservoir and to the east. Developed flows will be captured by proposed storm sewer and routed to proposed pond 37. Proposed stormwater facility design to be provided in future Phase III Drainage Report.

Basin 37A (53.11 acres)

Consists of open space. Undeveloped flows will be conveyed through sheet flow and natural channels to South Newlin Gulch where they ultimately drain to Reuter-Hess Reservoir.

Basin 64 (5.40 acres)

Consists of open space. Undeveloped flows will be conveyed through sheet flow and natural channels to the east to Lemon Gulch Tributary.

# III – EXISTING STORMWATER CONVEYANCE OR STORAGE FACILITIES

## A. Existing Stormwater Conveyance Facilities

South Newlin Gulch, along with its tributaries convey storm water from the area included in the PD Amendment No. 2. These flows are naturally routed into the Rueter Hess Reservoir located northeast of the proposed development.

## B. Existing Stormwater Storage Facilities

There are existing agricultural ponds dispersed throughout the site. These ponds are not considered for stormwater management infrastructure, however some of the existing pond locations may be used to construct proposed detention ponds that serve the site.

# IV – PROPOSED STORMWATER CONVEYANCE OR STOARGE FACILITES

## A. Proposed Stormwater Conveyance Facilities

The site will generally follow the historic drainage pattern with some minor rerouting due to the proposed development in each planning area respectively. Proposed detention ponds will be utilized and are generally located on the Drainage Map. The detention pond locations are conceptual and are subject to adjustments through the design of each of these planning areas. It is noted, that utilizing grading and stormwater conveyance measures that there will be the opportunity during final design to consolidate detention facilities. This will create the opportunity for an urban environment that will preserve natural drainage patterns. Off-site runoff entering the site will be routed through the site to generally maintain the historical drainage pattern. No drainage conveyance problems are anticipated with this project, as stormwater flows will generally be conveyed within each Planning Area to localized detention facilities where flows will be discharged to the existing regional drainageways. All drainage conveyance facilities will be designed with suitable access and maintenance that will meet the requirements of the Douglas County Storm Drainage Design and Technical Criteria Manual and the City of Castle Pines.

### B. Proposed Stormwater Storage Facilities

The site will utilize extended detention ponds for water quality and storage. The proposed development will either have a new detention pond or will be able to utilize and reconfigure the existing agricultural ponds. The ponds and outlet structures will be designed as full-spectrum detention ponds that include Water Quality Capture Volume (WQCV), Excess Urban Runoff Volume (EURV), and the 100-year storm event that will release at the appropriate rates. Detention pond volumes for each basin will be calculated using the Urban Drainage spreadsheet for full-spectrum detention. A maintenance access road, per Douglas County design criteria, shall be provided for access to each outlet structure. The final layout and location of the proposed ponds is subject to change and will be detailed in future Phase III Drainage Reports.

## V. WATER QUALITY ENHANCEMENT BEST MANAGEMENT PRACTICES

### A. Non-structural Best Management Practices

The drainage design for the Canyons will incorporate the non-structural Best Management Practices (BMP's) as outlined in Volume 3 of the Urban Drainage and Flood Control District's Drainage Criteria Manual. Individual BMP's will be determined for each site within the development during final design. The major runoff pollutant generated from lawns will be phosphorus contained in fertilizers. Paved areas will generate pollutants such as oil, gasoline, etc. The concept of pollutant removal as recommended in Volume 3 of the Urban Drainage and Flood Control District's Drainage Criteria Manual has also been adopted by the Cherry Creek Basin Authority (Watershed Plan 2003, Chapter 3.1.3) and will be implemented in this development.

### B. Structural Best Management Practices

The developer is considering Low Impact Design (LID) for stormwater discharge principles in the drainage design of the Canyons PD 2nd Amendment. The drainage design for the Canyons will incorporate several different types of structural Best Management Practices (BMP's) as outlined in Volume 3 of the Urban Drainage and Flood Control District's Drainage Criteria Manual. Such structural BMP's may include Extended Detention Basins (EDB), Grass Swales (GS), Grass Buffers (GB), and Porous Landscape Detention (PLD). The design and location of these BMP's will be determined in subsequent reports. For the purpose of this report, detention ponds have been conceptually located as shown on the drainage plan. Ponds are designed to collect runoff, detain and discharge at historic rates. Regular maintenance will occur to ensure that the BMP's function properly. Maintenance access will also be designed for each BMP in subsequent reports. Water quality measures have been included in the design of the proposed extended detention basins. The basins are designed to incorporate structures that release flows for the Water Quality Capture Volume (WQCV), Excess Urban Runoff Volume (EURV), and the 100-year storm event.

# VI – FLOODPLAIN MODIFICATIONS

## A. Major Drainageway – Undesignated Floodplain

During preliminary and final design, the un-delineated major drainageway floodplains will be identified and delineated. Efforts will be made to protect and preserve the natural drainage ways that traverse the site. Impacts will be limited to improvements in the areas of discharges from the proposed detention facilities and will conform to the Urban Drainage and Flood Control District's (UDFCD) criteria. These improvements will be designed to mitigate erosion and preserve the natural character and historical drainage patterns to the greatest extent feasible.

## B. Major Drainageway – Designated Floodplain

Currently, no modifications to the existing floodplains, as defined by the FEMA Flood Insurance Rate Maps (FIRM), are planned within the area of this amendment. Proposed detention ponds will generally be located adjacent (offline) to the drainageways. Online detention ponds may be considered as a measure to consolidate detention facilities that discharge to a common drainageway.

Design measures will help minimize the adverse effects due to the increase in runoff within the drainageways. The impact of proposed development on the area will be well mitigated and the steps taken for water quality control will exceed the usually required measures by the City of Castle Pines and Urban Drainage. Impacts and stability analysis to the Major Drainageways, notably Lemon Gulch, will be further studied and analyzed during the preliminary and final designs of the project.

If modifications to the existing floodplains are required during detailed final design, then they will result in a revision to the FIRM map. This is done by submitting a Conditional Letter of Map Revision (CLOMR). A CLOMR outlines the reasoning for the change and defines the new floodplain. After improvements to the drainageways are complete, a Letter of Map Revision (LOMR) is submitted to show that the channel improvements were constructed to the specifications outlined in the CLOMR, and that the floodplain is accurately mapped.

# VII. POTENTIAL PERMITTING REQUIREMENTS

Other than permitting through the City of Castle Pines, there is no other potential permitting required for the developments located within PD Amendment.

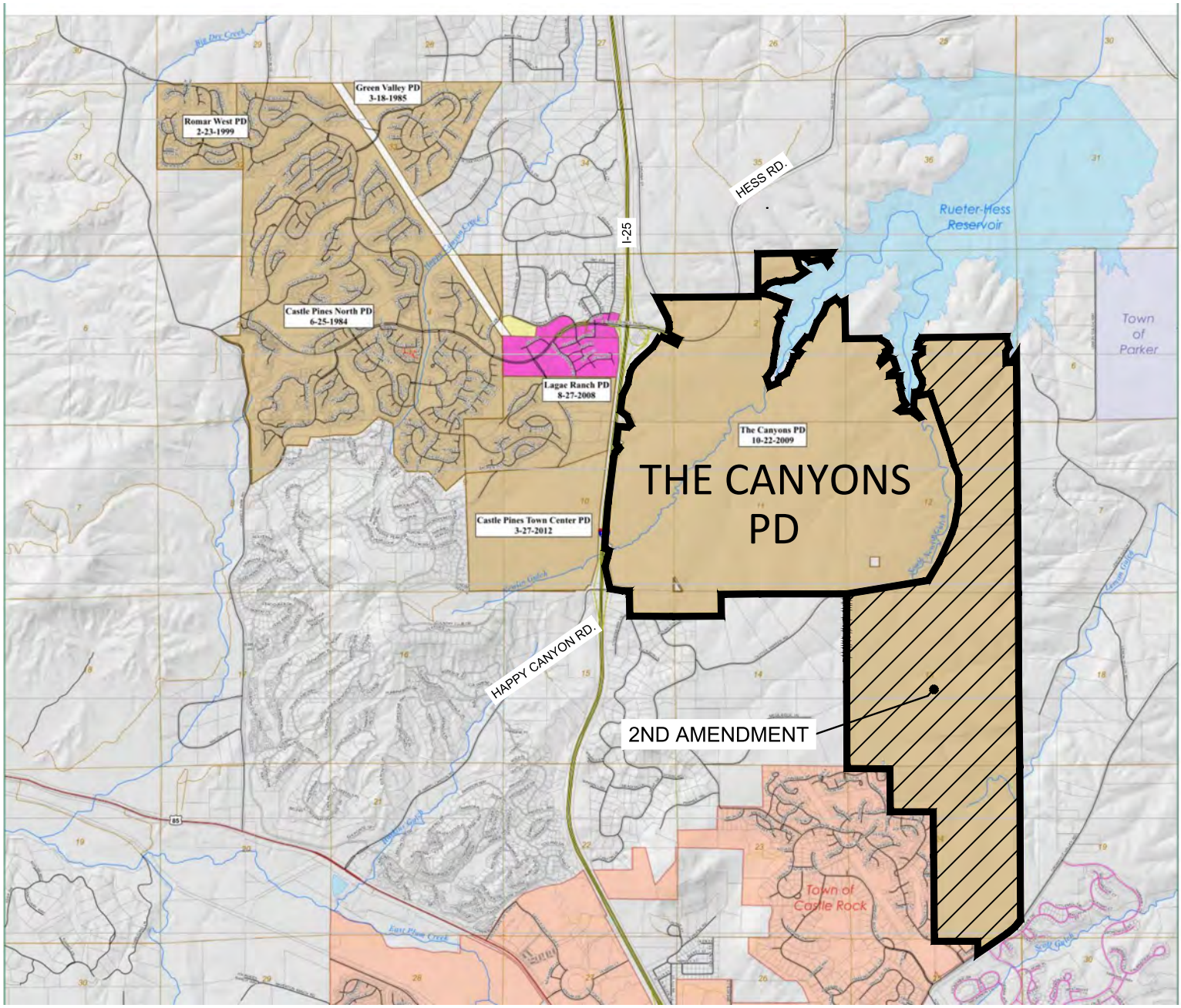
# REFERENCES

A. Douglas County Storm Drainage Design and Technical Criteria Manual, Amended July 2008.

B. Drainage Criteria Manual, Volumes 1, 2, & 3, Urban Drainage and Flood Control District, Volumes 1 and 2 – Updated January 2016; Volume 3 - Updated November 2010.

C. Newlin & Baldwin Gulches and Basin 4600-09 Outfall Systems Planning Study Preliminary Design Report, Kiowa Engineering Corporation. December 1994.

D. Phase I Drainage Report for The Canyons, Nolte Associates, Inc. June 2009.




## VICINITY MAP

0 10,000' 20,000'

SCALE: 1" = 10,000'

## NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables shown on this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Floodway Data table shown on this FIRM.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 13. The **horizontal datum** was NAD 83, GRS 1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242**, or visit its website at http://www.ngs.noaa.gov.

**Base map** information shown on this FIRM was provided by the Douglas County GIS Department and the Town of Castle Rock GIS Department. Additional input was provided by the City of Lone Tree and Town of Parker. These data are current as of 2010.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **profile baselines** depicted on this map represent the hydraulic modeling baselines that match the flood profiles in the FIS report. As a result of improved topographic data, the **profile baseline**, in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.

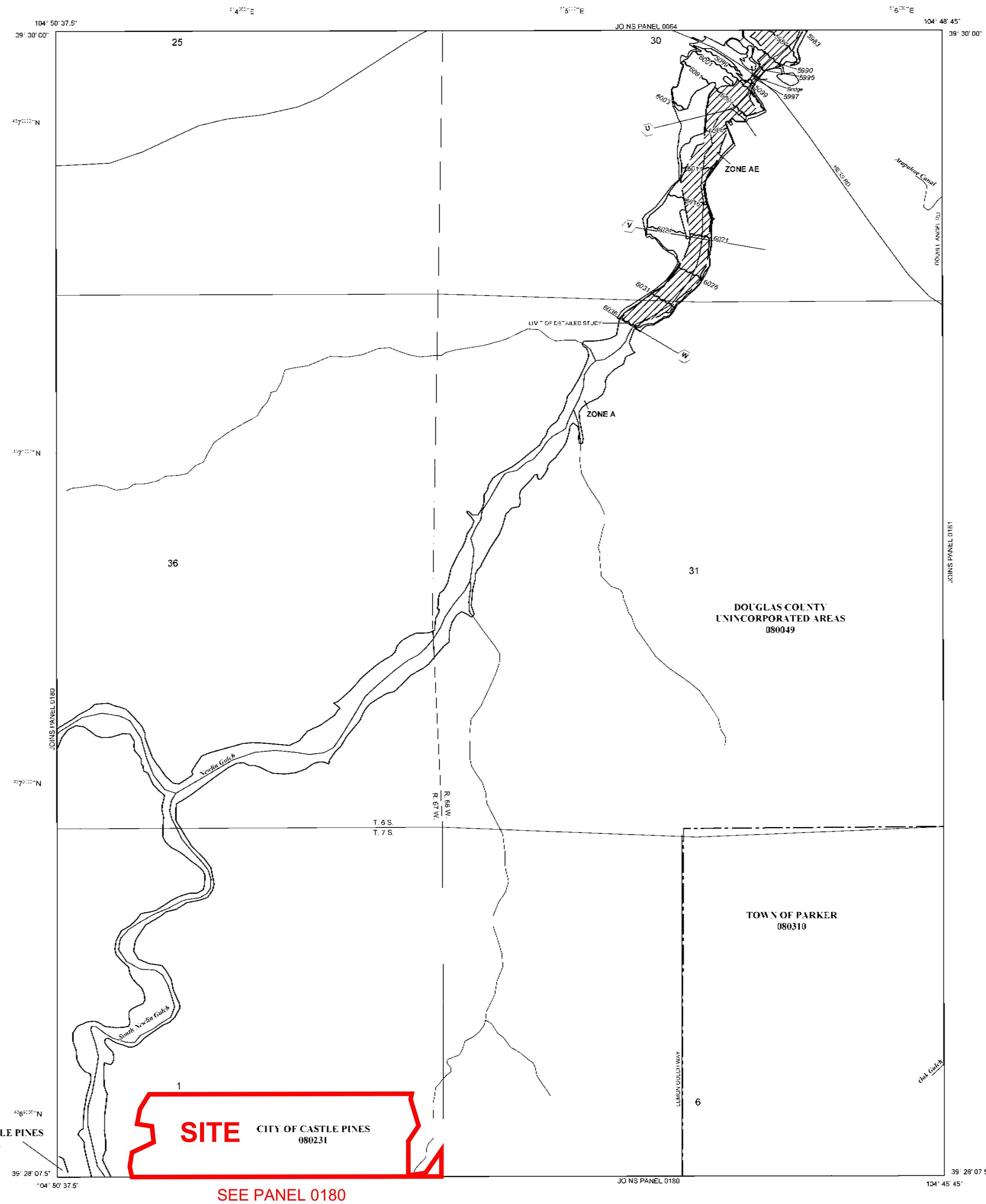
Based on updated topographic information, this map reflects more detailed and up-to-date **stream channel configurations** and **floodplain delineations** than those shown on the previous FIRM for this jurisdiction. As a result, the Flood Profiles and Floodway Data tables for multiple streams in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on the map. Also, the road to floodplain relationships for unrevised streams may differ from what is shown on previous maps.

**Corporate limits** shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

For information on available products associated with this FIRM visit the **Map Service Center (MSC)** website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the MSC website.

If you have **questions about this map**, how to order products, or the National Flood Insurance Program in general, please call the **FEMA Map Information eXchange (FMIX)** at **1-877-FEMA-MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.




## LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

**ZONE A** No Base Flood Elevations determined.
**ZONE AE** Base Flood Elevations determined.
**ZONE AH** Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
**ZONE AO** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
**ZONE AR** Special Flood Hazard Areas formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
**ZONE A99** Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
**ZONE V** Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
**ZONE VE** Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

**ZONE X** Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

**ZONE X** Areas determined to be outside the 0.2% annual chance floodplain.
**ZONE D** Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% Annual Chance Floodplain Boundary
0.2% Annual Chance Floodplain Boundary
Floodway boundary
Zone D boundary
CBRS and OPA boundary
Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.
~~~ 513 ~~~ Base Flood Elevation line and value; elevation in feet*
(EL 987) Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

(A)——(A) Cross section line
(23)- - - -(23) Transect line
45° 02' 08", 93° 02' 12" Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
4989000 N 1000-meter Universal Transverse Mercator grid values, zone 13
DX5510 × Bench mark (see explanation in Notes to Users section of this FIRM panel)
• M1.5 River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
SEPTEMBER 30, 2005

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

MARCH 16, 2016 to update corporate limits, to change base flood elevations, to add base flood elevations, to add special flood hazard areas, to update map format, to add roads and road names, to reflect updated topographic information, to incorporate previously issued letters of map revision

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

| 250 | 0 | 500 | 1000 FEET |
|---|---|---|---|
| 150 | 0 | 150 | 300 METERS |

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0177G

# FIRM
## FLOOD INSURANCE RATE MAP
## DOUGLAS COUNTY, COLORADO
### AND INCORPORATED AREAS

PANEL 177 OF 495
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

| COMMUNITY | NUMBER | PANEL | SUFFIX |
|---|---|---|---|
| DOUGLAS COUNTY | 080049 | 0177 | G |
| PARKER, TOWN OF | 080310 | 0177 | G |
| CASTLE PINES, CITY OF | 080231 | 0177 | G |

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

**MAP NUMBER**
**08035C0177G**
**MAP REVISED**
**MARCH 16, 2016**

Federal Emergency Management Agency
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## NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures.** Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) Zone 13. The **horizontal datum** was NAD 83, GRS80 spheroid. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988 (NAVD 88). These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. An average offset between NAVD 88 and the National Geodetic Vertical Datum of 1929 (NGVD 29) has been computed for each Douglas County flooding source. This offset was then applied to the NGVD 29 flood elevations that were not revised during the creation of this countywide format FIRM. The offsets for each flooding source shown on this FIRM are shown in the Douglas County Vertical Datum Offset Table below. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

Spatial Reference System Division
National Geodetic Survey, NOAA
Silver Spring Metro Center
1315 East-West Highway
Silver Spring, Maryland 20910
(301) 713-3191

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242**, or visit its website at http://www.ngs.noaa.gov. For information about additional control points maintained by Douglas County, please visit http://www.publicstaging.douglas.co.us/website/control/viewer.htm.

**Base map** information shown on this FIRM was provided by the Douglas County GIS Department and the Town of Castle Rock GIS Department. Additional input was provided by the City of Lone Tree and Town of Parker. These data are current as of 2003.

This map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map. Also, the road to floodplain relationships for unrevised streams may differ from what is shown on previous maps.

**Corporate limits** shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. The Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov.

### Douglas County Vertical Datum Offset Table

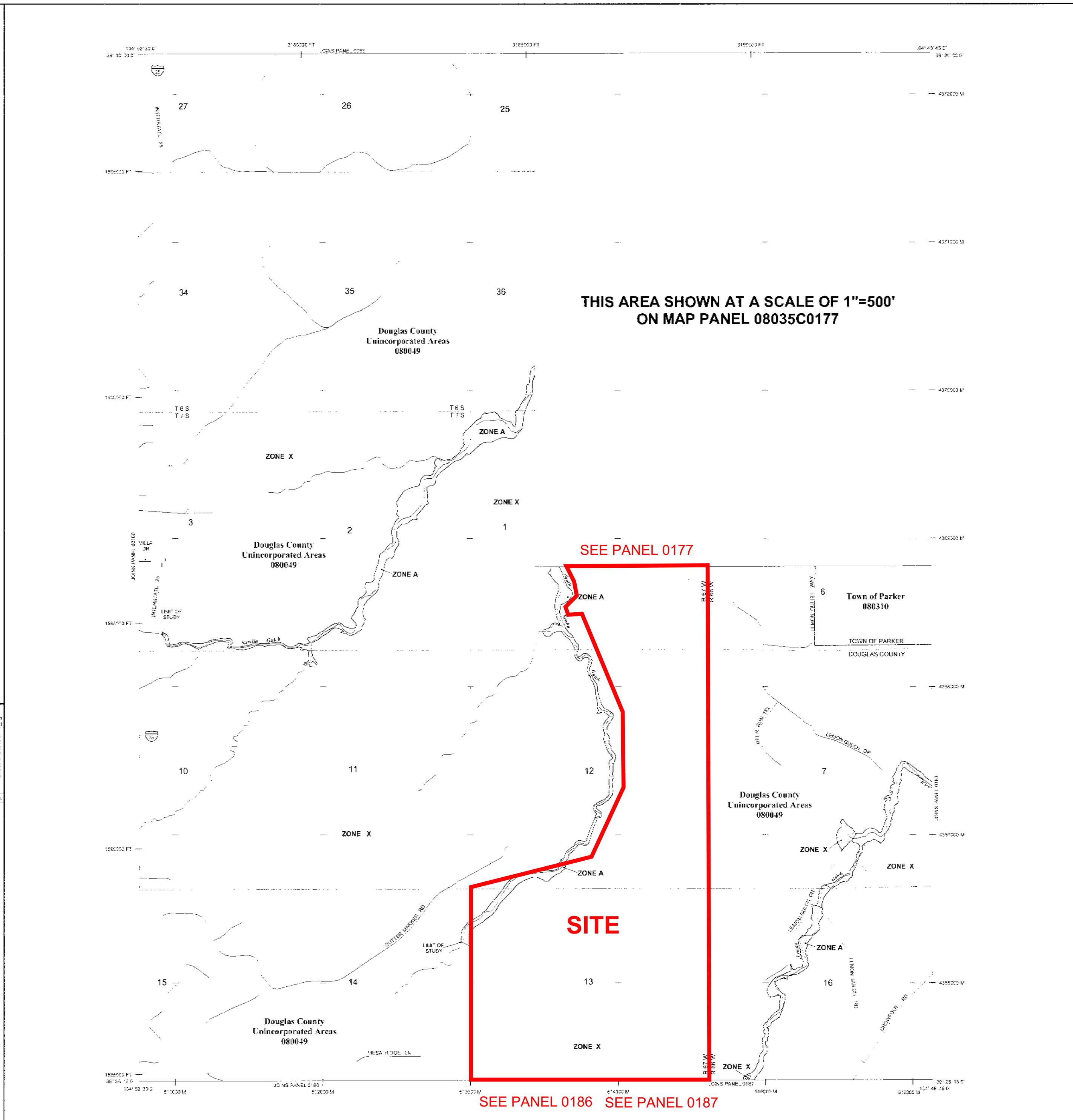
| Flooding Source | Vertical Datum Offset (ft) | Flooding Source | Vertical Datum Offset (ft) |
|---|---|---|---|
| Baldwin Gulch | 3.13 | Newlin Gulch | 3.14 |
| Bayou Gulch | 3.22 | Plum Creek Cross Section A to D | 3.12 |
| Big Dry Creek Tributary C | 3.15 | Section 34 Tributary | 3.32 |
| Carpenter Creek | 3.63 | Sellers Gulch | 3.43 |
| Cherry Creek Cross Section BZ to DJ | 3.23 | Sellers Gulch Unnamed Tributary | 3.39 |
| East Plum Creek Cross Section W to AY | 3.26 | Sulphur Gulch | 3.12 |
| East Plum Creek Cross Section AZ to CZ | 3.49 | Tallman Gulch | 3.15 |
| East Plum Creek Cross Section DA to EM | 3.71 | West Plum Creek Cross Section W to AM | 3.33 |
| Glade Gulch | 3.65 | | |
| Happy Canyon Creek | 3.12 | | |

Example: To convert Baldwin Gulch elevations to NAVD 88, 3.13 feet were added to the NGVD 29 elevations.

**Panel Location Map**

This digital Flood Insurance Rate Map (FIRM) was produced through a cooperative partnership between the State of Colorado Water Conservation Board, the Urban Drainage and Flood Control District, and the Federal Emergency Management Agency (FEMA). The State of Colorado Water Conservation Board and the Urban Drainage and Flood Control District have implemented a long-term approach of floodplain management to reduce the costs associated with flooding. As part of this effort, both the State of Colorado and the Urban Drainage and Flood Control District have joined in Cooperating Technical Partner agreements with FEMA to produce this digital FIRM.

Additional flood hazard information and resources are available from local communities, the Colorado Water Conservation Board, and the Urban Drainage and Flood Control District.




## LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAS) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

ZONE A — No Base Flood Elevations determined.
ZONE AE — Base Flood Elevations determined.
ZONE AH — Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO — Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined.
ZONE AR
ZONE A99

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

ZONE X

OTHER AREAS

ZONE X — Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D — Areas in which flood hazards are undetermined, but possible.

Floodplain boundary
Floodway boundary
Zone D boundary

Boundary dividing Special Flood Hazard Area zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.

Base Flood Elevation line and value; elevation in feet*

Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

Cross section line

MAP REPOSITORY
Refer to listing of Map Repositories on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
SEPTEMBER 30, 2005

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

MAP SCALE 1" = 1000'

500 0 1000 2000 FEET
300 0 300 600 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0180F

# FIRM
FLOOD INSURANCE RATE MAP

DOUGLAS COUNTY,
COLORADO
AND INCORPORATED AREAS

PANEL 180 OF 495
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

| COMMUNITY | NUMBER | PANEL | SUFFIX |
|---|---|---|---|

MAP NUMBER
08035C0180F

EFFECTIVE DATE:
SEPTEMBER 30, 2005

Federal Emergency Management Agency

## NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables shown or this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Floodway Data table shown on this FIRM.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 13. The **horizontal datum** was NAD 83, GRS 1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242**, or visit its website at http://www.ngs.noaa.gov.

**Base map** information shown on this FIRM was provided by the Douglas County GIS Department and the Town of Castle Rock GIS Department. Additional input was provided by the City of Lone Tree and Town of Parker. These data are current as of 2010.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **profile baselines** depicted on this map represent the hydraulic modeling baselines that match the flood profiles in the FIS report. As a result of improved topographic data the **profile baseline**, in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.

Based on updated topographic information this map reflects more detailed and up-to-date **stream channel configurations** and **floodplain delineations** than those shown on the previous FIRM for this jurisdiction. As a result the Flood Profiles and Floodway Data tables for multiple streams in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on the map. Also, the road to floodplain relationships for unrevised streams may differ from what is shown on previous maps.

**Corporate limits** shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

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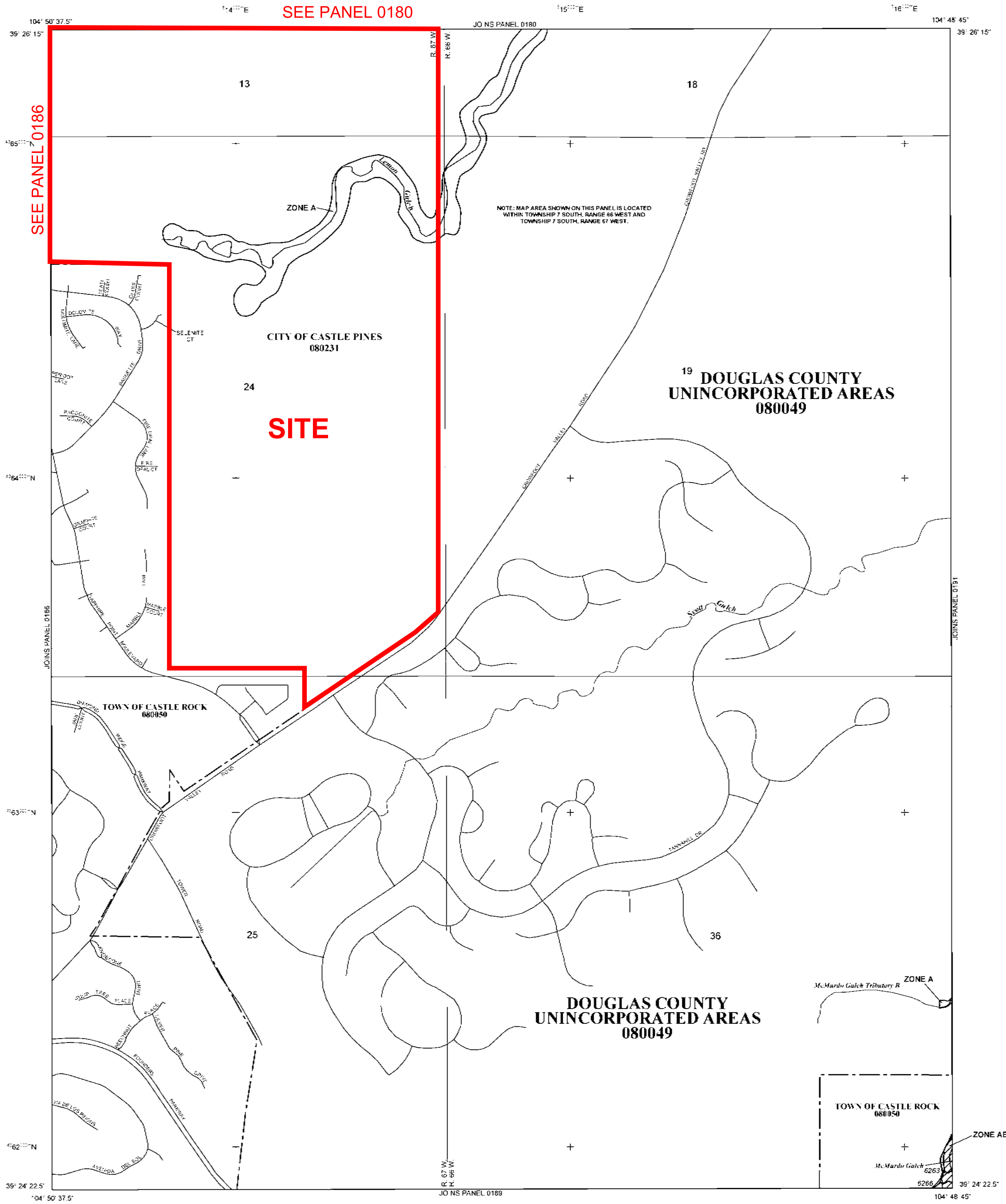
For information on available products associated with this FIRM visit the **Map Service Center (MSC)** website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the MSC website.

If you have **questions about this map**, how to order products, or the National Flood Insurance Program in general, please call the **FEMA Map Information eXchange (FMIX)** at **1-877-FEMA-MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.




## LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

**ZONE A** No Base Flood Elevations determined.

**ZONE AE** Base Flood Elevations determined.

**ZONE AH** Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.

**ZONE AO** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.

**ZONE AR** Special Flood Hazard Areas formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.

**ZONE A99** Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.

**ZONE V** Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.

**ZONE VE** Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

**ZONE X** Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

**ZONE X** Areas determined to be outside the 0.2% annual chance floodplain.

**ZONE D** Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- 1% Annual Chance Floodplain Boundary
- 0.2% Annual Chance Floodplain Boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.
- ~~~ 513 ~~~ Base Flood Elevation line and value; elevation in feet*
- (EL 987) Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

- (A)—(A) Cross section line
- (23)- - - -(23) Transect line
- 45° 02' 08", 93° 02' 12" Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
- $^{4989}$000 N 1000-meter Universal Transverse Mercator grid values, zone 13
- DX5510 × Bench mark (see explanation in Notes to Users section of this FIRM panel)
- • M1.5 River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
SEPTEMBER 30, 2005

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

MARCH 16, 2016 - to update corporate limits, to change base flood elevations, to add base flood elevations, to add special flood hazard areas, to update map format, to add roads and road names, to reflect updated topographic information, to incorporate previously issued letters of map revision.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET
150 0 150 300 METERS

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NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0187G

# FIRM
FLOOD INSURANCE RATE MAP

DOUGLAS COUNTY, COLORADO
AND INCORPORATED AREAS

PANEL 187 OF 495
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

| COMMUNITY | NUMBER | PANEL | SUFFIX |
|---|---|---|---|
| CASTLE ROCK, TOWN OF | 080050 | 0187 | G |
| DOUGLAS COUNTY | 080049 | 0187 | G |
| CASTLE PINES, CITY OF | 080231 | 0187 | G |

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**MAP NUMBER**
**08035C0187G**
**MAP REVISED**
**MARCH 16, 2016**

Federal Emergency Management Agency

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The **profile baselines** depicted on this map represent the hydraulic modeling baselines that match the flood profiles in the FIS report. As a result of improved topographic data, the **profile baseline**, in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.

Based on updated topographic information, this map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. As a result, the Flood Profiles and Floodway Data tables for multiple streams in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map. Also, the road-to-floodplain relationships for unrevised streams may differ from what is shown on previous maps.

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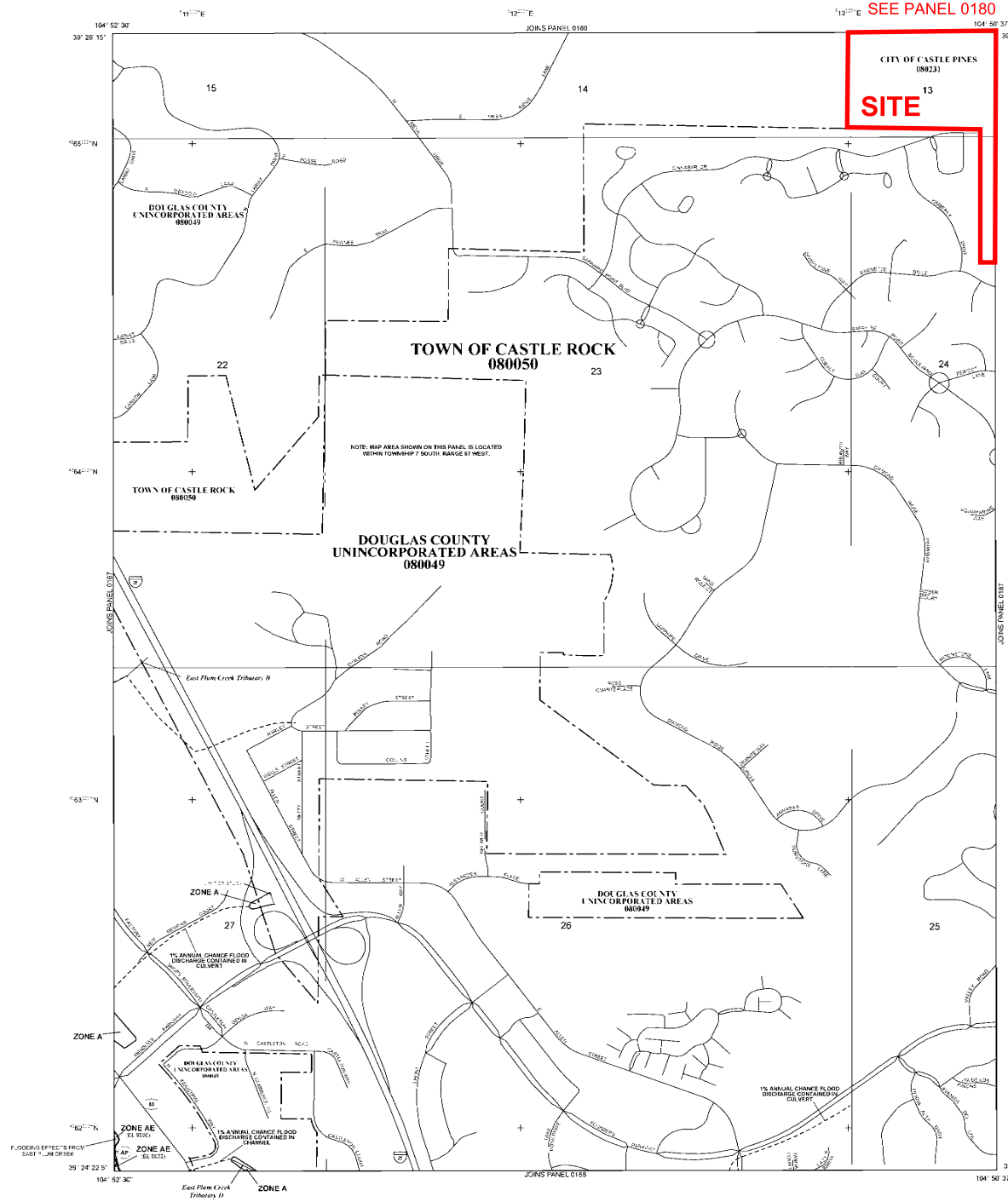


## LEGEND

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- **ZONE A** — No Base Flood Elevations determined.
- **ZONE AE** — Base Flood Elevations determined.
- **ZONE AH** — Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
- **ZONE AO** — Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
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- **ZONE A99** — Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
- **ZONE V** — Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
- **ZONE VE** — Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

- **ZONE X** — Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

- **ZONE X** — Areas determined to be outside the 0.2% annual chance floodplain.
- **ZONE D** — Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

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- 1% Annual Chance Floodplain Boundary
- 0.2% Annual Chance Floodplain Boundary
- Floodway Boundary
- Zone D Boundary
- CBRS and OPA Boundary
- Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.
- 513 — Base Flood Elevation line and value; elevation in feet*
- (EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988

- (A) — (A) — Cross section line
- (23) — (23) — Transect line
- 45° 02' 08", 93° 02' 12" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
- 4939000 mN — 1000-meter Universal Transverse Mercator grid values, zone 13
- DX5510 — Bench mark (see explanation in Notes to Users section of this FIRM panel)
- M1.5 — River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP

SEPTEMBER 30, 2005

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

MARCH 16, 2016 to update corporate limits, to change base flood elevations, to add base flood elevations, to add special flood hazard areas, to update map format, to add roads and road names, to reflect updated topographic information, to incorporate previously issued letters of map revision

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

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MAP SCALE 1" = 500'

250 0 500 1000 FEET
150 0 150 300 METERS

NATIONAL FLOOD INSURANCE PROGRAM

**PANEL 0186G**

# FIRM

## FLOOD INSURANCE RATE MAP

## DOUGLAS COUNTY, COLORADO AND INCORPORATED AREAS

**PANEL 186 OF 495**
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

| COMMUNITY | NUMBER | PANEL | SUFFIX |
|---|---|---|---|
| CASTLE ROCK, TOWN OF | 080050 | 0186 | G |
| DOUGLAS COUNTY | 080049 | 0186 | G |
| CASTLE PINES, CITY OF | 080231 | 0186 | G |

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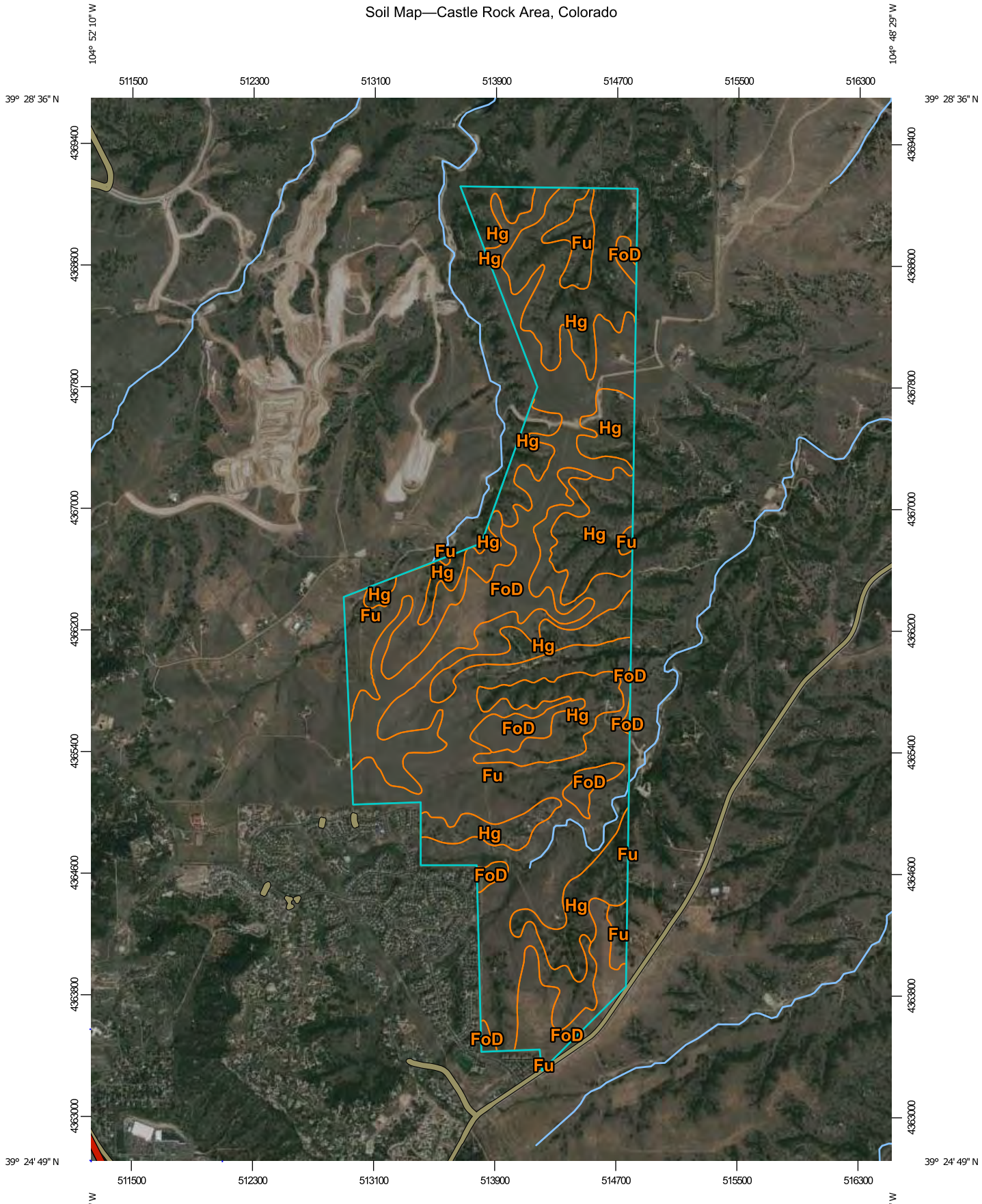
**MAP NUMBER**
**08035C0186G**
**MAP REVISED**
**MARCH 16, 2016**

Federal Emergency Management Agency

# Soil Map—Castle Rock Area, Colorado




Map Scale: 1:34,100 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0, 500, 1000, 2000, 3000

Feet: 0, 1500, 3000, 6000, 9000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

## MAP LEGEND

**Area of Interest (AOI)**

- Area of Interest (AOI)

**Soils**

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

**Special Point Features**

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

**Water Features**

- Streams and Canals

**Transportation**

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

**Background**

- Aerial Photography

## MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Castle Rock Area, Colorado
Survey Area Data: Version 11, Sep 10, 2018

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

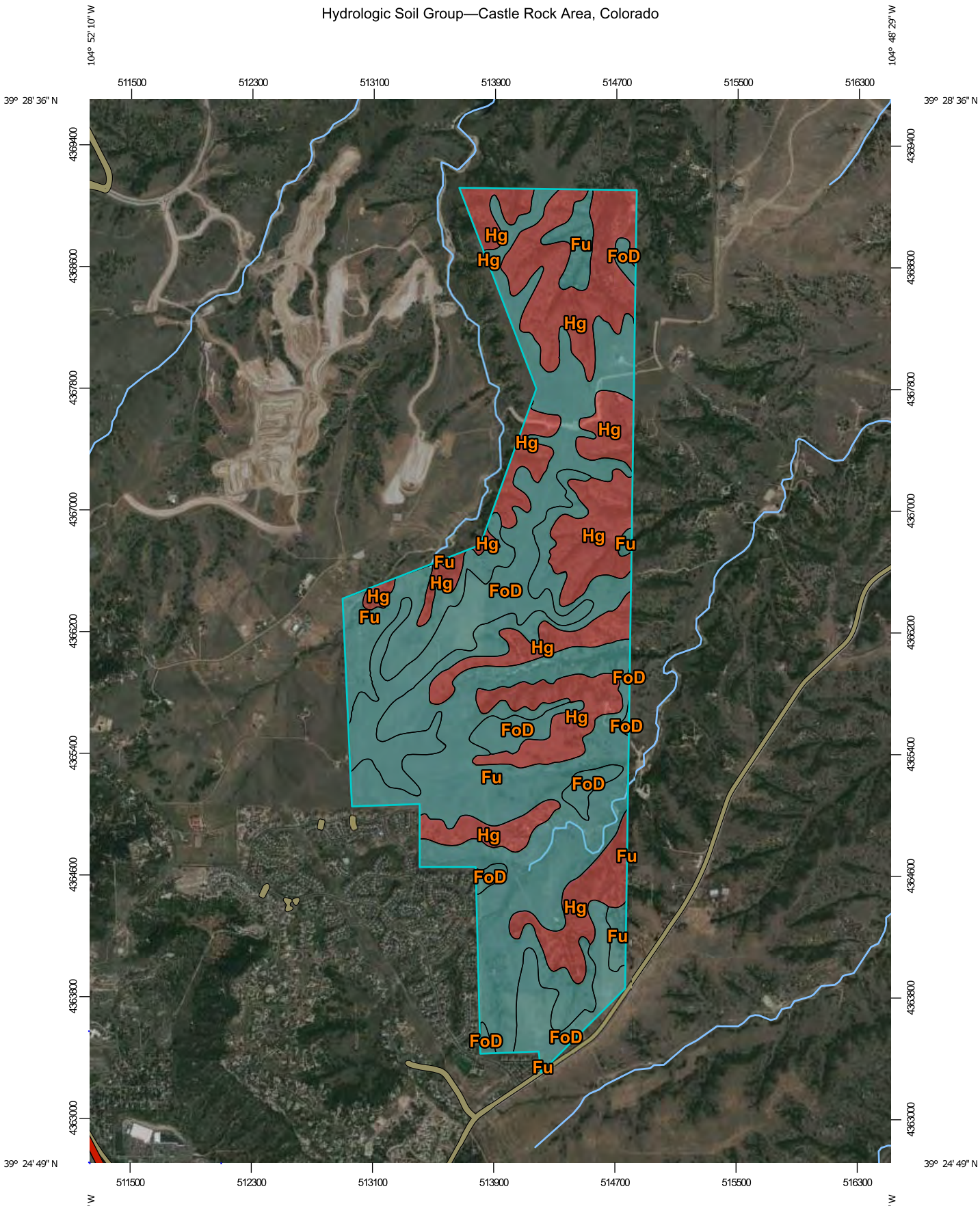
Date(s) aerial images were photographed: Jul 24, 2018—Nov 19, 2018

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

# Map Unit Legend

| Map Unit Symbol | Map Unit Name | Acres in AOI | Percent of AOI |
|---|---|---|---|
| FoD | Fondis clay loam, 3 to 9 percent slopes | 428.6 | 25.6% |
| Fu | Fondis-Kutch association | 673.4 | 40.3% |
| Hg | Hilly gravelly land | 569.3 | 34.1% |
| **Totals for Area of Interest** | | **1,671.3** | **100.0%** |

# Hydrologic Soil Group—Castle Rock Area, Colorado




Map Scale: 1:34,100 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 500 1000 2000 3000

Feet: 0 1500 3000 6000 9000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

## MAP LEGEND

**Area of Interest (AOI)**

Area of Interest (AOI)

**Soils**

**Soil Rating Polygons**

A

A/D

B

B/D

C

C/D

D

Not rated or not available

**Soil Rating Lines**

A

A/D

B

B/D

C

C/D

D

Not rated or not available

**Soil Rating Points**

A

A/D

B

B/D

C

C/D

D

Not rated or not available

**Water Features**

Streams and Canals

**Transportation**

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

**Background**

Aerial Photography

## MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Castle Rock Area, Colorado
Survey Area Data: Version 11, Sep 10, 2018

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 24, 2018—Nov 19, 2018

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

# Hydrologic Soil Group

| Map unit symbol | Map unit name | Rating | Acres in AOI | Percent of AOI |
|---|---|---|---|---|
| FoD | Fondis clay loam, 3 to 9 percent slopes | C | 428.6 | 25.6% |
| Fu | Fondis-Kutch association | C | 673.4 | 40.3% |
| Hg | Hilly gravelly land | D | 569.3 | 34.1% |
| **Totals for Area of Interest** | | | **1,671.3** | **100.0%** |

## Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

## Rating Options

*Aggregation Method:* Dominant Condition

*Component Percent Cutoff: None Specified*

*Tie-break Rule:* Higher

# Phase I Drainage Report

# For

# The Canyons

*Prepared for:*

The CANYONS

NORTH CANYONS, LLLP.
3033 E. First Avenue Suite 501
Denver, CO 80206

*Prepared by:*

NOLTE

NOLTE ASSOCIATES, INC.
8000 South Chester Street Suite 200
Centennial, Colorado 80112

April, 2009
Revised June, 2009

# *TABLE OF CONTENTS*


| SECTION | PAGE |
|---|---|
| INTRODUCTION | 1 |
| GENERAL LOCATION AND DESCRIPTION | 1 |
| Site Location | 1 |
| Description of Property | 1 |
| DRAINAGE BASINS AND SUB-BASINS | 2 |
| Major Drainage Basins | 2 |
| Minor Drainage Basins | 3 |
| EXISTING STORMWATER CONVEYANCE OR STORAGE FACILITIES | 3 |
| Existing Stormwater Conveyance Facilities | 3 |
| Existing Stormwater Storage Facilities | 3 |
| PROPOSED STORMWATER CONVEYANCE OR STORAGE FACILITIES | 3 |
| Proposed Stormwater Conveyance Facilities | 3 |
| Proposed Stormwater Storage Facilities | 4 |
| WATER QUALITY ENHANCEMENT BEST MANAGEMENT PRACTICES | 4 |
| Non-Structural Best Management Practices | 4 |
| Structural Best Management Practices | 5 |
| FLOODPLAIN MODIFICATIONS | 5 |
| Major Drainageway – Undesignated Floodplain | 5 |
| Major Drainageway – Designated Floodplain | 5 |
| POTENTIAL PERMITTING REQUIREMENTS | 6 |
| REFERENCES | 7 |

## *TABLE OF CONTENTS – Appendicies*

**Appendix A**

Vicinity Map
FEMA Flood Insurance Rate Map
Soil Classification Map

**Appendix B**

Figures from Douglas County Storm Drainage and Technical Criteria Manual
Figures from Urban Drainage and Flood Control District Drainage Criteria Manual

**Appendix C**

Composite Runoff Coefficient Table
Composite Imperviousness and Required Detention Table
Detention Pond Sizing Table

**Map Pockets**

General Location Map
Detailed Drainage Maps

## INTRODUCTION

This report addresses the proposed improvements to The Canyons development site, totaling approximately 3,342.4 acres. The drainage design emphasizes the preservation of the drainageways by maintaining historic peak flows. In cases where historic peak flows are exceeded a combination of grade controls and drainageway monitoring is prescribed. This report illustrates the proposed drainage patterns and calculates the required detention volume.

## I. GENERAL LOCATION AND DESCRIPTION

### A. Site Location

The Canyons property is a tract of land located in sections 1, 2, 3, 10, 11, 12, 13, 14, 15, 24 and 25 of Township 7 South, Range 67 west of the Sixth Principal Meridian, County of Douglas, State of Colorado. The Canyons property encompasses approximately 3,342.4 acres. The property is bounded on the west by Interstate 25, on the north by Freshfields Inc. and Parker Water and Sanitation District's property, on the east by Castle Park Ranch, and on the south by Crowfoot Valley Road, Sapphire Point, and Happy Canyon Ranches. The property has two main access points to Interstate 25 at Castle Pines Parkway and Happy Canyon Road. The City of Castle Pines North is located to the west of the site, along with the Castle Pines Village development. The proposed Canyons Parkway bisects the site running north-south from the proposed Hess Road to Crowfoot Valley Road. The proposed extension of Happy Canyon Road will run east-west from Interstate 25 to Canyons Parkway. The properties to the north, east and west of the site are located in unincorporated Douglas County. The Town of Castle Rock borders portions to the southwest. The location of the site is shown on the Vicinity Map in Appendix A.

Major drainageways near and through the proposed development include Newlin Gulch, South Newlin Gulch and the contributing Roundtop, Mesa and Spring tributaries that convey flows through a majority of the site to the north. Lemon Gulch conveys runoff through the southern portion of the site from west to east. The entire site lies in the head waters of the Cherry Creek Watershed. The site is tributary to Rueter Hess Reservoir, which is located north of the Canyons.

### B. Description of Property

The site encompasses approximately 3,342.4 acres which has typical slopes ranging from 4% to 10%, with some eroded areas along the channel bottom that are nearly vertical. Vegetation consists of native grasses, scrub oak above the major drainage ways and a few scattered Ponderosa Pines.

Within the Canyons, the soil is generally comprised of Fondis-Kutch association (Fu), Fondis clay loam (FoD), and hilly gravelly land (Hg) which fall under the C and D soil

classifications. Some wider streambeds contain sandy alluvial land (Sd), Sampson Clay Loam (Sa), and Bresser-Truckton sandy loams (BtE) that are classified as soil group B. Further detailed information is provided on the soils classification map in Appendix A.

Portions of the Newlin, South Newlin and Lemon Gulches located inside the site's boundary have been assigned a Zone A designation according to the FEMA Flood Insurance Rate Maps (FIRM) 08035C0180F (Ref. 1) and 08035C0187F (Ref. 2) shown on the FIRM Map exhibit in Appendix A. Newlin and South Newlin Gulches and the contributing Roundtop, Mesa and Spring tributaries lie in the upper portion of Cherry Creek watershed. Newlin and South Newlin Gulches run through the northern portion of the site from southwest to northeast flowing into the proposed Rueter Hess Reservoir just north of the property. Flows released from Rueter Hess Reservoir will enter back into Newlin Gulch and combine with Cherry Creek downstream of the site boundary. The existing channel bottom slope through the Canyons site ranges from one to six percent. The rest of the site to the south lies in the Lemon Gulch watershed which flows to the east. The offsite flows are released at historic rates through detention ponds from the Sapphire Point and Diamond Ridge developments to the west. There are no irrigation ditches or other artificial storm water conveyances existing at the site.

The Canyons will conserve the rural character of Douglas County and provide distinctive open space living including single family detached residential units, a potential 27-hole golf course, parks, mixed use areas, and high quality open space.

## II. DRAINAGE BASINS AND SUB-BASINS

### A. Major Drainage Basins

Historically, runoff within the Canyons property drains into the existing channels, and the channels convey the runoff to the north and east. The proposed basin delineation shown in this report reflects the current site plan and the existing topography of the site. In the General Location Map, Major Basin A encompasses the northern portion of the site. A majority of the site discharge through this basin to the north via Newlin and South Newlin Gulches. The Southern portion of the site discharges to the east via Lemon Gulch in Major Basin B. Offsite runoff from adjacent properties to the west will be conveyed through the site via Newlin and Lemon Gulches. Currently the site is undeveloped and is used primarily for cattle grazing. The site is covered with native vegetation, and generally has slopes ranging from 4-10%, with steeper slopes adjacent to drainage channels. Proposed development within the site includes single family detached homes, parks, a potential golf course, and mixed use areas.

The ***Newlin & Baldwin Gulches and Basin 4600-09 Outfall Systems Planning Study Preliminary Design Report*** (OSP) (Ref. 4) defined sub-basins for the Newlin Gulch watershed in the northern portion of the site. The ***Lemon and Scott Gulches Outfall Systems Planning-Alternatives Evaluation Report*** (OSP) (Ref.5) defined sub-basins for the Lemon Gulch watershed. These studies will be used as a basis for historical runoff addressed in this report and in future drainage reports. Portions of the Newlin, South

Newlin and Lemon Gulches located within the site boundary have been designated Zone A according to the FIRMs 08035C0180F and 08035C0187F shown on the FIRM Map in Appendix A.

### B. Minor Drainage Basins

The proposed basin delineation in this report reflects the current site plan. The proposed basins generally convey flows as they would historically release with some minor rerouting due to proposed roadways. The site splits flow with a majority discharging to the north via Newlin and South Newlin Gulches while the rest of the site flows to the east via Lemon Gulch. Proposed development within the site includes single family detached homes, parks, a potential golf course, and mixed use areas. Detention ponds are placed in order to control discharge into existing channels at historic rates and to comply with the water quality requirements of Douglas County and the Cherry Creek Basin Authority. Offsite flows will be conveyed through existing channels, storm sewer and swales to avoid conflicts with proposed lots. The Drainage Basin Maps in Appendix B show the sub-basin boundaries and acreages.

## III. EXISTING STORMWATER CONVEYANCE OR STORAGE FACILITIES

### A. Existing Stormwater Conveyance Facilities

Newlin Gulch, South Newlin Gulch, along with their tributaries will convey storm water from northern portion of the site and into the proposed Rueter Hess Reservoir located just north of the Canyons property. Lemon Gulch will convey storm water from southern portion of the site. Channel improvements will be designed and constructed to ensure channel stability and will prevent erosion. Box Culverts under Interstate 25 will convey runoff from offsite basins onto the Canyons property. Channel improvements will be designed and implemented as warranted throughout the site.

### B. Existing Stormwater Storage Facilities

A portion of the existing stock ponds within the Canyons property may be used as storage facilities. These ponds will be refurbished with outlet structures, and the embankments will be rebuilt to City of Castle Pines North and Urban Drainage specifications. The stock ponds and dams will be evaluated as needed during the subdivision process.

## IV. PROPOSED STORMWATER CONVEYANCE OR STORAGE FACILITIES

### A. Proposed Stormwater Conveyance Facilities

Historically, runoff within the Canyons property drains into the existing channels, and the channels convey the runoff to the north and east. The proposed basin delineation in this report reflects the current site plan and the existing topography of the site. Slight deviations from the historic drainage patterns are a result of the proposed roadways and land uses within the site. Offsite runoff from adjacent properties to the west will be

conveyed through the site via Newlin and Lemon Gulches. Channel improvements will be designed and constructed to ensure channel stability. Calculations in Appendix C show the composite imperviousness and runoff coefficient values based on the land use types proposed within the Canyons property. These imperviousness values provide a more accurate value for the required detention volume for a drainage basin. Planning Areas 5, 7-9, 11, and 13-18 are proposed to have a single family residential density of 1.15 units per acre, based on the conceptual planning per the PD document. The PD proposes a maximum of 2,500 residential units, and the drainage report assumes that 1,500 units will be located in the residential planning areas. The rest of the residential units are conceptually located in the mixed use areas. Planning Areas 10 and 12 is comprised of large lot residential units, having the same imperviousness as open space. Planning Areas 1-4, 6, and 19 are proposed as mixed use. Drainage basins that encompass Canyons Parkway, Happy Canyon Road, and Hess Road will include an imperviousness value for the major roadway. All other areas within the Canyons property will have an open space designation. Required detention volume calculations can also be found in Appendix C. The drainage design will conform to the Douglas County Drainage Criteria Manual (Ref. 6), and the Urban Drainage and Flood Control District Drainage Criteria Manual (Ref. 7).

### B. Proposed Stormwater Storage Facilities

The drainage maps located at the back of this report show the conceptual detention pond locations for the Canyons property. The drainage design for the site may utilize some of the existing on-line stock ponds for storage facilities. The existing ponds will be evaluated as needed during the subdivision process. These ponds will be refurbished with outlet structures, and the embankments will be rebuilt to City of Castle Pines North and Urban Drainage specifications. The detention pond spreadsheet in Appendix C details which drainage basins contribute to each of the proposed detention ponds. This spreadsheet also shows the required volume for each pond. Maintenance access to each detention pond will be designed as part of the Phase III Drainage Report and final design for the site.

## V. WATER QUALITY ENHANCEMENT BEST MANAGEMENT PRACTICES

### A. Non-structural Best Management Practices

The drainage design for the Canyons will incorporate the non-structural Best Management Practices (BMP's) as outlined in Volume 3 of the Urban Drainage and Flood Control District's Drainage Criteria Manual. The major runoff pollutant generated from lawns will be phosphorus contained in fertilizers. Paved areas will generate pollutants such as oil, gasoline, etc. The concept of pollutant removal as recommended in Volume 3 of the Urban Drainage and Flood Control District's Drainage Criteria Manual has also been adopted by the Cherry Creek Basin Authority (Watershed Plan 2003, Chapter 3.1.3) and will be implemented in this development.

### B. Structural Best Management Practices

The developer is considering extensive Low Impact Design (LID) and Minimizing Directly Connected Impervious Area (MDCIA) principles in the drainage design of the Canyons. The drainage design for the Canyons will incorporate several different types of structural Best Management Practices (BMP's) as outlined in Volume 3 of the Urban Drainage and Flood Control District's Drainage Criteria Manual. Such structural BMP's will include Extended Detention Basins (EDB), Grass Swales (GS), Grass Buffers (GB), and Porous Landscape Detention (PLD). The design and location of these BMP's will be determined in subsequent reports. For the purpose of this report, detention ponds have been conceptually designed and located. Supporting calculations are presented in the imperviousness and detention volume worksheets in Appendix C. The drainage maps in the back of this report show the conceptual locations of the detention ponds. Ponds are designed to collect runoff, detain and discharge at historic rates. Regular maintenance will occur to ensure that the BMP's function properly. Maintenance access will also be designed for each BMP in subsequent reports.

## VI. FLOODPLAIN MODIFICATIONS

### A. Major Drainageway – Undesignated Floodplain

Potential modifications to the drainageways will be a result in the increasing runoff due to the proposed development within the Canyons property. Improvements to drainageways may include many of the recommendations included within the ***Newlin & Baldwin Gulches and Basin 4600-09 Outfall Systems Planning Study Preliminary Design Report*** (OSP) and the ***Lemon and Scott Gulches Outfall Systems Planning-Alternatives Evaluation Report*** (OSP). The channel improvements will also conform to the Urban Drainage and Flood Control District's criteria. These improvements include check structures, bank lining, and reinforced low flow channels at various locations in the major drainageways of Lemon Gulch and Newlin Gulch. These improvements that are planned for these areas will be equivalent to the recommendations made in the above mentioned reports, but will be designed to preserve the natural character of the drainageways to the greatest extent feasible.

### B. Major Drainageway – Designated Floodplain

As previously mentioned, potential modifications to major drainageways with a designated floodplain will be a result of the increased runoff due to the proposed development within the Canyons property. Improvements to drainageways will follow the recommendations as outlined in the ***Newlin & Baldwin Gulches and Basin 4600-09 Outfall Systems Planning Study Preliminary Design Report*** (OSP) and the ***Lemon and Scott Gulches Outfall Systems Planning-Alternatives Evaluation Report*** (OSP). The channel improvements will also conform to the Urban Drainage and Flood Control District's criteria. These improvements include check structures, bank lining, and reinforced low flow channels at various locations in the major drainageways of Lemon Gulch and Newlin Gulch. These improvements that are planned for these areas will be

equivalent to the recommendations made in the above mentioned reports, but will be designed to preserve the natural character of the drainageways to the greatest extent feasible.

Any modifications to the existing floodplains, as defined by the FEMA Flood Insurance Rate Maps (FIRM) will result in a revision to the FIRM map. This is done by submitting a Conditional Letter of Map Revision (CLOMR). A CLOMR outlines the reasoning for the change, and defines the new floodplain. After improvements to the drainageways are complete, a Letter of Map Revision (LOMR) is submitted to show that the channel improvements were constructed to the specifications outlined in the CLOMR, and that the floodplain is accurately mapped.

Design measures will help minimize the adverse affects due to the increase in runoff within the drainageways. The impact of proposed development on the area will be well mitigated and the steps taken for water quality control will exceed the usually required measures by the City of Castle Pines North and Urban Drainage.

## VII. POTENTIAL PERMITTING REQUIREMENTS

There are no other potential permitting requirements that have been identified at this time, than what is required by the City of Castle Pines North. ERO has prepared a wetlands report which identifies the jurisdictional wetlands within the Canyons property. However, with the construction of Rueter Hess Reservoir, additional areas within Newlin Gulch are being evaluated, and may be added to the report.

## VII. REFERENCES


1. Flood Insurance Rate Map, Douglas County, Colorado. Panel No. 08035C0180F, dated September 30, 2005.

2. Flood Insurance Rate Map, Douglas County, Colorado. Panel No. 08035C0187F, dated September 30, 2005.

3. The Canyons Phase I Drainage Report, Psomas. – March, 2006.

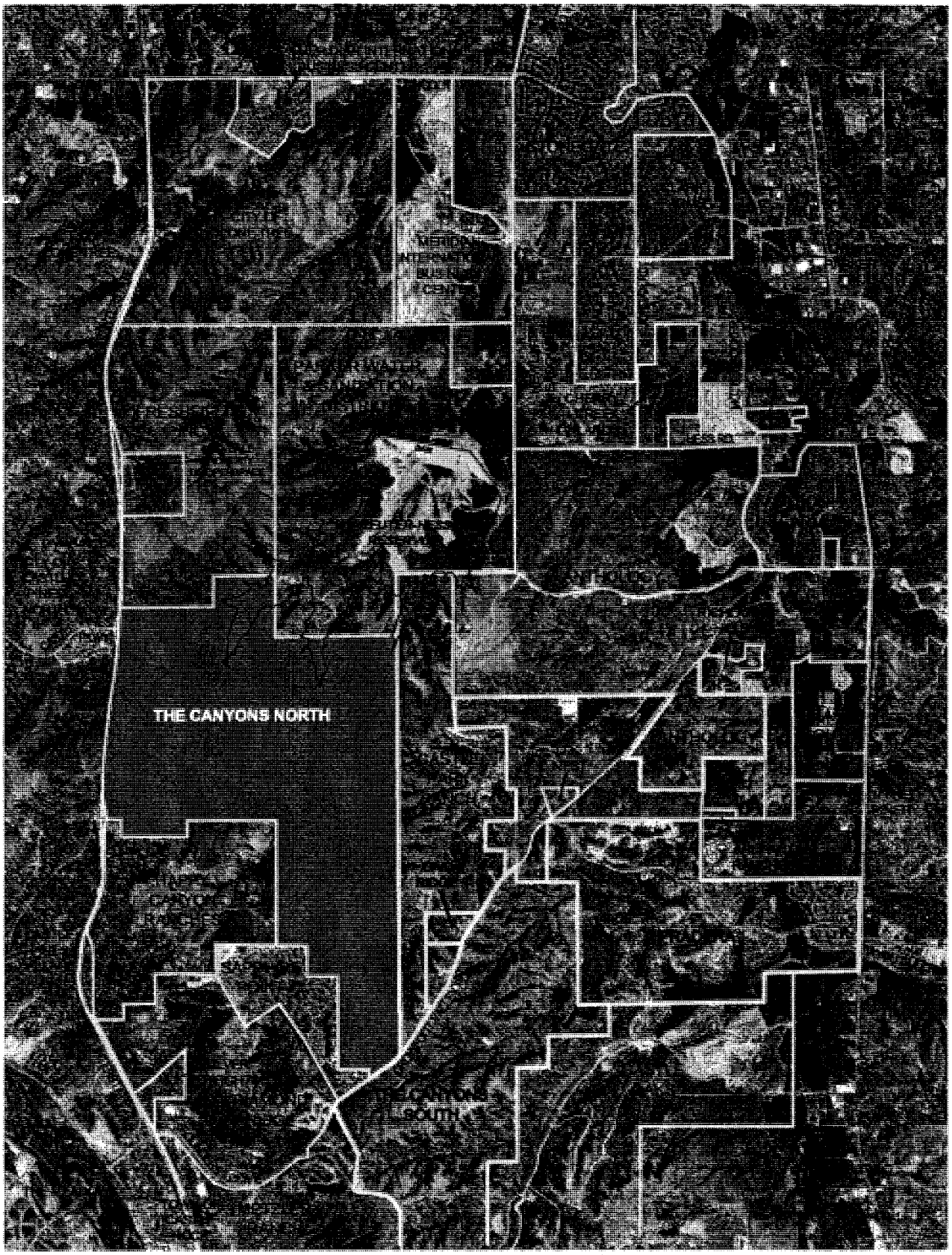
4. Newlin & Baldwin Gulches and Basin 4600-09 Outfall Systems Planning Study Preliminary Design Report, Kiowa Engineering Corporation. December, 1994.

5. Lemon and Scott Gulches Outfall Systems Planning Alternatives Evaluation Report, CH2M Hill. November 2005.

6. Douglas County Storm Drainage Design and Technical Criteria, Urban Drainage Flood Control District and WRC Engineering, Inc. Adopted January, 1986, Amended July 2008.

7. Urban Drainage Criteria Manual – Volumes 1 and 3, Urban Drainage Flood Control District. September, 2001.

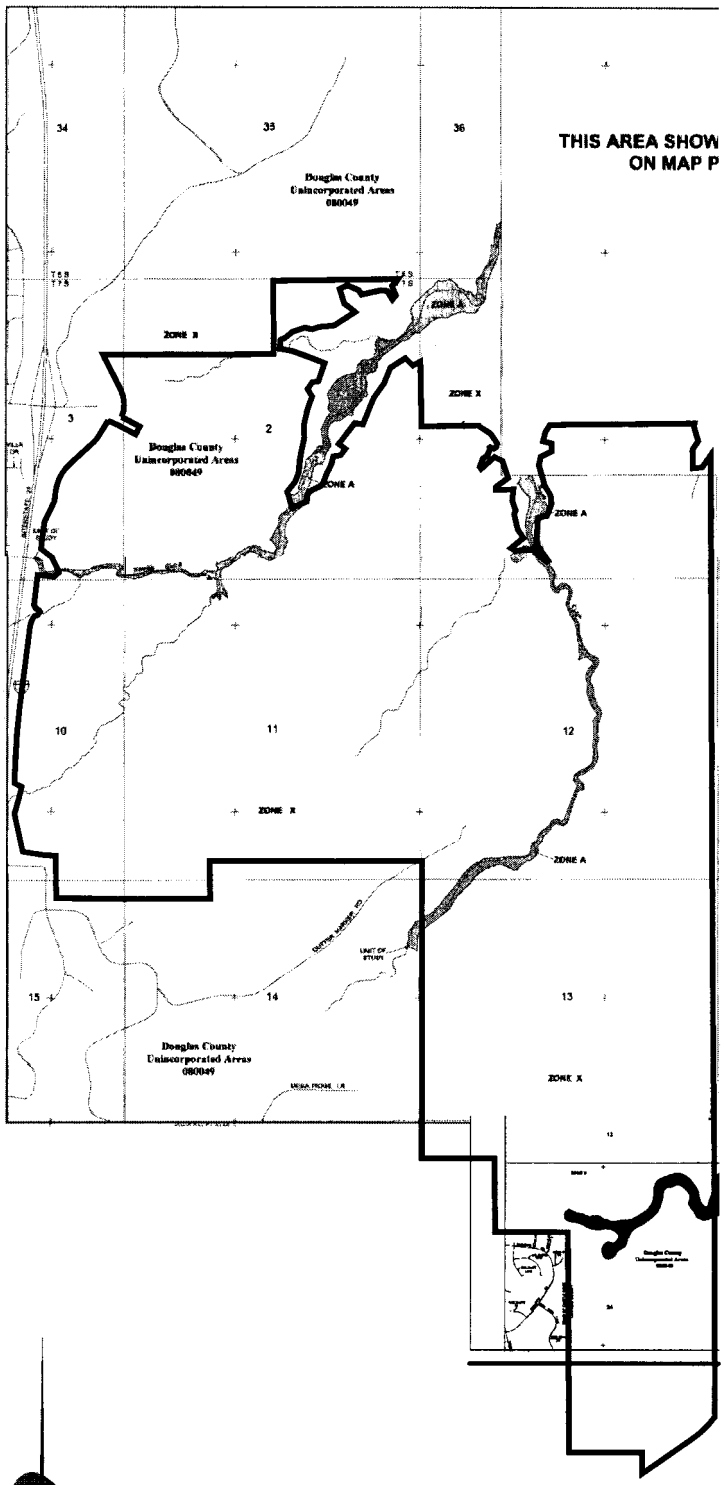
# APPENDIX A

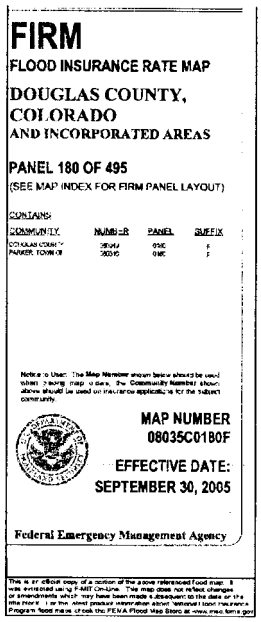



N

NOLTE
BEYOND ENGINEERING

**Exhibit 1**
**Vicinity Map**



FIRM

FLOOD INSURANCE RATE MAP

DOUGLAS COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 180 OF 495

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

| COMMUNITY | NUMBER | PANEL | SUFFIX |
|---|---|---|---|
| DOUGLAS COUNTY | 080049 | 0180 | F |
| PARKER, TOWN OF | 080310 | 0180 | F |

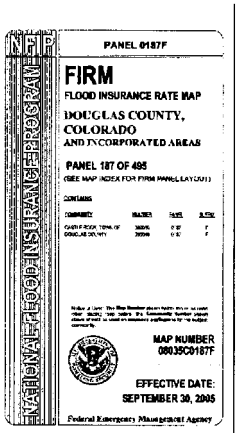
Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.

MAP NUMBER
08035C0180F

EFFECTIVE DATE:
SEPTEMBER 30, 2005

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov



NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0187F

FIRM

FLOOD INSURANCE RATE MAP

DOUGLAS COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 187 OF 495

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

| COMMUNITY | NUMBER | PANEL | SUFFIX |
|---|---|---|---|
| CASTLE ROCK, TOWN OF | 080050 | 0187 | F |
| DOUGLAS COUNTY | 080049 | 0187 | F |

MAP NUMBER
08035C0187F

EFFECTIVE DATE:
SEPTEMBER 30, 2005

Federal Emergency Management Agency

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FIRM Map

NOLTE
BEYOND ENGINEERING
8000 S. Chester Street, Suite 200 Centennial, CO 80112
303.220.8400 TEL 303.220.9001 FAX www.NOLTE.COM

# APPENDIX B

**Table RO-3—Recommended Percentage Imperviousness Values**

| Land Use or Surface Characteristics | Percentage Imperviousness |
|---|---|
| Business: | |
| Commercial areas | 95 |
| Neighborhood areas | 85 |
| Residential: | |
| Single-family | * |
| Multi-unit (detached) | 60 |
| Multi-unit (attached) | 75 |
| Half-acre lot or larger | * |
| Apartments | 80 |
| Industrial: | |
| Light areas | 80 |
| Heavy areas | 90 |
| Parks, cemeteries | 5 |
| Playgrounds | 10 |
| Schools | 50 |
| Railroad yard areas | 15 |
| Undeveloped Areas: | |
| Historic flow analysis | 2 |
| Greenbelts, agricultural | 2 |
| Off-site flow analysis (when land use not defined) | 45 |
| Streets: | |
| Paved | 100 |
| Gravel (packed) | 40 |
| Drive and walks | 90 |
| Roofs | 90 |
| Lawns, sandy soil | 0 |
| Lawns, clayey soil | 0 |

* See Figures RO-3 through RO-5 for percentage imperviousness.

$$C_A = K_A + \left(1.31i^3 - 1.44i^2 + 1.135i - 0.12\right) \text{ for } C_A \geq 0, \text{ otherwise } C_A = 0 \qquad \text{(RO-6)}$$

$$C_{CD} = K_{CD} + \left(0.858i^3 - 0.786i^2 + 0.774i + 0.04\right) \qquad \text{(RO-7)}$$

$$C_B = \left(C_A + C_{CD}\right)/2$$

**Table RO-5— Runoff Coefficients, *C***

| Percentage Imperviousness | Type C and D NRCS Hydrologic Soil Groups | | | | | |
|---|---|---|---|---|---|---|
| | 2-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr |
| 0% | 0.04 | 0.15 | 0.25 | 0.37 | 0.44 | 0.50 |
| 5% | 0.08 | 0.18 | 0.28 | 0.39 | 0.46 | 0.52 |
| 10% | 0.11 | 0.21 | 0.30 | 0.41 | 0.47 | 0.53 |
| 15% | 0.14 | 0.24 | 0.32 | 0.43 | 0.49 | 0.54 |
| 20% | 0.17 | 0.26 | 0.34 | 0.44 | 0.50 | 0.55 |
| 25% | 0.20 | 0.28 | 0.36 | 0.46 | 0.51 | 0.56 |
| 30% | 0.22 | 0.30 | 0.38 | 0.47 | 0.52 | 0.57 |
| 35% | 0.25 | 0.33 | 0.40 | 0.48 | 0.53 | 0.57 |
| 40% | 0.28 | 0.35 | 0.42 | 0.50 | 0.54 | 0.58 |
| 45% | 0.31 | 0.37 | 0.44 | 0.51 | 0.55 | 0.59 |
| 50% | 0.34 | 0.40 | 0.46 | 0.53 | 0.57 | 0.60 |
| 55% | 0.37 | 0.43 | 0.48 | 0.55 | 0.58 | 0.62 |
| 60% | 0.41 | 0.46 | 0.51 | 0.57 | 0.60 | 0.63 |
| 65% | 0.45 | 0.49 | 0.54 | 0.59 | 0.62 | 0.65 |
| 70% | 0.49 | 0.53 | 0.57 | 0.62 | 0.65 | 0.68 |
| 75% | 0.54 | 0.58 | 0.62 | 0.66 | 0.68 | 0.71 |
| 80% | 0.60 | 0.63 | 0.66 | 0.70 | 0.72 | 0.74 |
| 85% | 0.66 | 0.68 | 0.71 | 0.75 | 0.77 | 0.79 |
| 90% | 0.73 | 0.75 | 0.77 | 0.80 | 0.82 | 0.83 |
| 95% | 0.80 | 0.82 | 0.84 | 0.87 | 0.88 | 0.89 |
| 100% | 0.89 | 0.90 | 0.92 | 0.94 | 0.95 | 0.96 |
| | **TYPE B NRCS HYDROLOGIC SOILS GROUP** | | | | | |
| 0% | 0.02 | 0.08 | 0.15 | 0.25 | 0.30 | 0.35 |
| 5% | 0.04 | 0.10 | 0.19 | 0.28 | 0.33 | 0.38 |
| 10% | 0.06 | 0.14 | 0.22 | 0.31 | 0.36 | 0.40 |
| 15% | 0.08 | 0.17 | 0.25 | 0.33 | 0.38 | 0.42 |
| 20% | 0.12 | 0.20 | 0.27 | 0.35 | 0.40 | 0.44 |
| 25% | 0.15 | 0.22 | 0.30 | 0.37 | 0.41 | 0.46 |
| 30% | 0.18 | 0.25 | 0.32 | 0.39 | 0.43 | 0.47 |
| 35% | 0.20 | 0.27 | 0.34 | 0.41 | 0.44 | 0.48 |
| 40% | 0.23 | 0.30 | 0.36 | 0.42 | 0.46 | 0.50 |
| 45% | 0.26 | 0.32 | 0.38 | 0.44 | 0.48 | 0.51 |
| 50% | 0.29 | 0.35 | 0.40 | 0.46 | 0.49 | 0.52 |
| 55% | 0.33 | 0.38 | 0.43 | 0.48 | 0.51 | 0.54 |
| 60% | 0.37 | 0.41 | 0.46 | 0.51 | 0.54 | 0.56 |
| 65% | 0.41 | 0.45 | 0.49 | 0.54 | 0.57 | 0.59 |
| 70% | 0.45 | 0.49 | 0.53 | 0.58 | 0.60 | 0.62 |
| 75% | 0.51 | 0.54 | 0.58 | 0.62 | 0.64 | 0.66 |
| 80% | 0.57 | 0.59 | 0.63 | 0.66 | 0.68 | 0.70 |
| 85% | 0.63 | 0.66 | 0.69 | 0.72 | 0.73 | 0.75 |
| 90% | 0.71 | 0.73 | 0.75 | 0.78 | 0.80 | 0.81 |
| 95% | 0.79 | 0.81 | 0.83 | 0.85 | 0.87 | 0.88 |
| 100% | 0.89 | 0.90 | 0.92 | 0.94 | 0.95 | 0.96 |

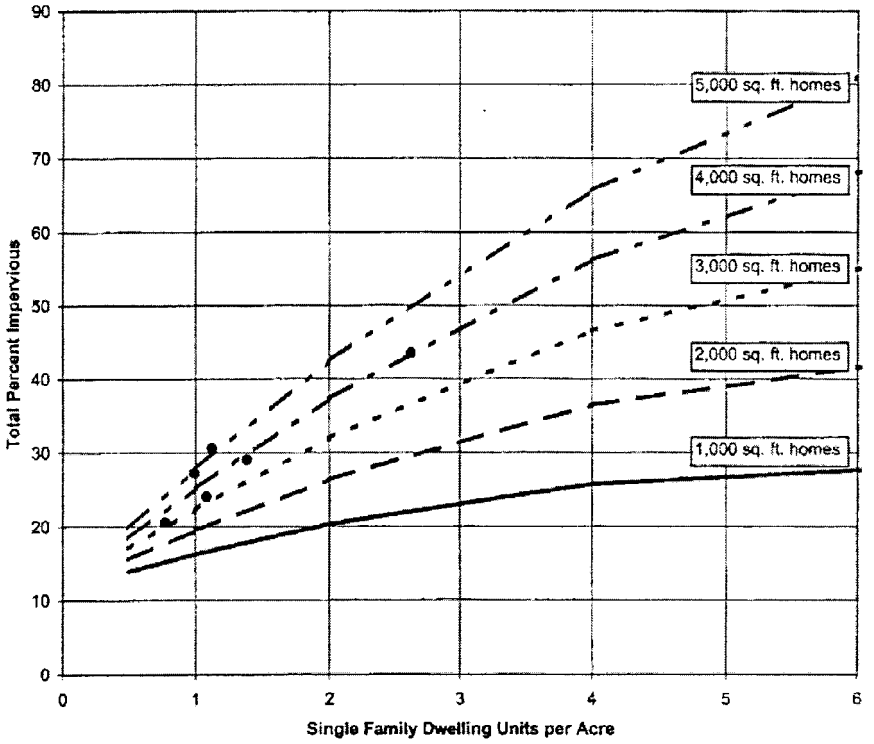



**Figure RO-5—Watershed Imperviousness, Single-Family Residential Two-Story Houses**

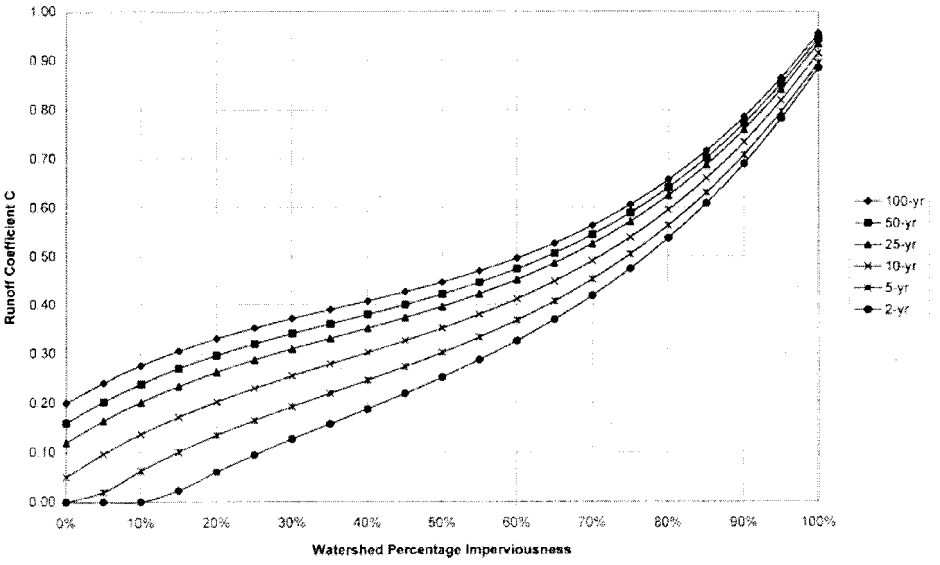



**Figure RO-6—Runoff Coefficient, *C*, vs. Watershed Percentage Imperviousness NRCS Hydrologic Soil Group A**

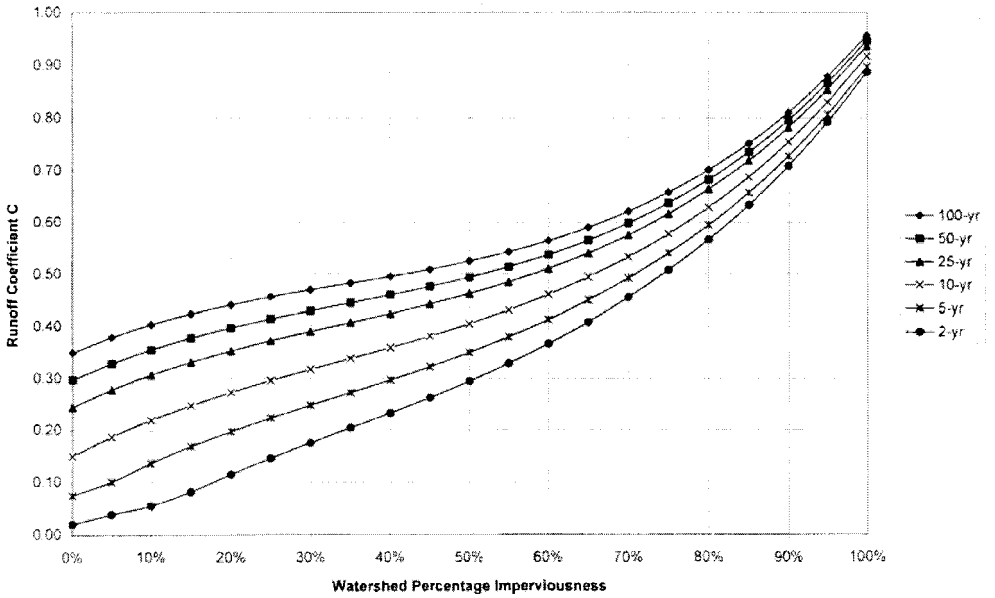



**Figure RO-7—Runoff Coefficient, *C*, vs. Watershed Percentage Imperviousness NRCS Hydrologic Soil Group B**

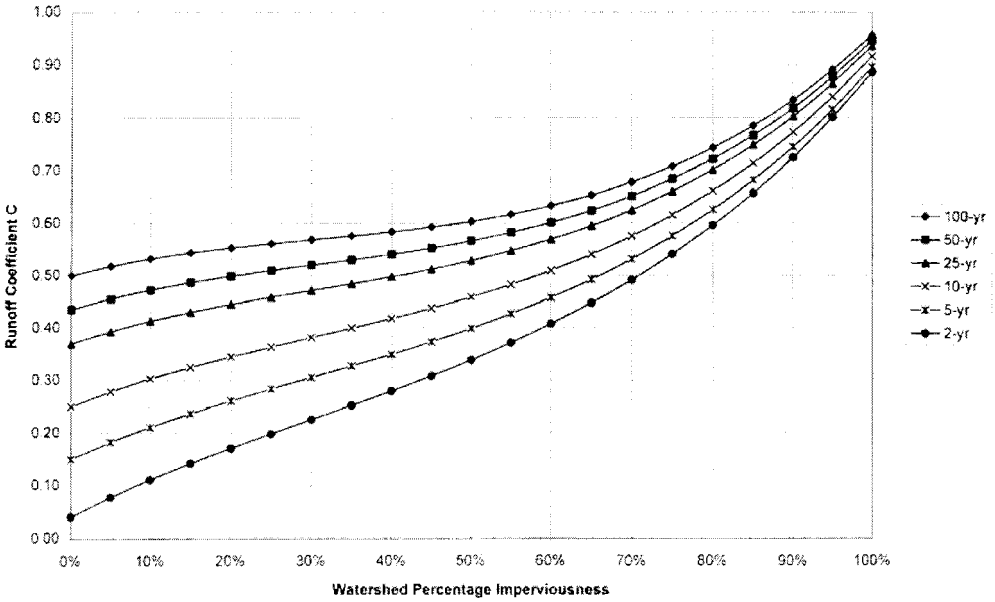



**Figure RO-8—Runoff Coefficient, *C*, vs. Watershed Percentage Imperviousness NRCS Hydrologic Soil Groups C and D**

# APPENDIX C

# COMPOSITE $C_5$ AND $C_{100}$

**Subdivision:** THE CANYONS
**Calculated by:** Phil Dalrymple
**Checked by:** Blake Calvert

**Nolte Job No.:** DVB032400
**Date:** August 26, 2009

| Sub Basin | Total Area (acres) | 2 Year Runoff Coefficients | | | | 5 Year Runoff Coefficients | | | | 100 Year Runoff Coefficients | | | | Total $C_2$ | Total $C_5$ | Total $C_{100}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0.05 Open Space (acres) | 0.22 Residential (acres) | 0.66 Mixed Use (acres) | 0.89 Paved (acres) | 0.15 Open Space (acres) | 0.30 Residential (acres) | 0.68 Mixed Use (acres) | 0.90 Paved (acres) | 0.51 Open Space (acres) | 0.57 Residential (acres) | 0.79 Mixed Use (acres) | 0.96 Paved (acres) | | | |
| 1 | 38.16 | 8.98 | 13.04 | 16.14 | 0.00 | 8.98 | 13.04 | 16.14 | 0.00 | 8.98 | 13.04 | 16.14 | 0.00 | 0.37 | 0.43 | 0.65 |
| 2 | 6.67 | 0.00 | 1.03 | 3.29 | 2.35 | 0.00 | 1.03 | 3.29 | 2.35 | 0.00 | 1.03 | 3.29 | 2.35 | 0.67 | 0.70 | 0.82 |
| 3 | 25.66 | 2.49 | 21.25 | 0.12 | 1.80 | 2.49 | 21.25 | 0.12 | 1.80 | 2.49 | 21.25 | 0.12 | 1.80 | 0.25 | 0.33 | 0.59 |
| 4 | 19.68 | 3.37 | 16.31 | 0.00 | 0.00 | 3.37 | 16.31 | 0.00 | 0.00 | 3.37 | 16.31 | 0.00 | 0.00 | 0.19 | 0.27 | 0.56 |
| 5 | 74.66 | 51.00 | 18.31 | 5.35 | 0.00 | 51.00 | 18.31 | 5.35 | 0.00 | 51.00 | 18.31 | 5.35 | 0.00 | 0.14 | 0.22 | 0.54 |
| 6 | 33.30 | 25.60 | 1.48 | 0.00 | 6.22 | 25.60 | 1.48 | 0.00 | 6.22 | 25.60 | 1.48 | 0.00 | 6.22 | 0.21 | 0.30 | 0.60 |
| 7 | 18.60 | 6.98 | 11.62 | 0.00 | 0.00 | 6.98 | 11.62 | 0.00 | 0.00 | 6.98 | 11.62 | 0.00 | 0.00 | 0.16 | 0.24 | 0.55 |
| 8 | 10.99 | 0.43 | 10.56 | 0.00 | 0.00 | 0.43 | 10.56 | 0.00 | 0.00 | 0.43 | 10.56 | 0.00 | 0.00 | 0.21 | 0.29 | 0.57 |
| 9 | 33.20 | 29.40 | 3.80 | 0.00 | 0.00 | 29.40 | 3.80 | 0.00 | 0.00 | 29.40 | 3.80 | 0.00 | 0.00 | 0.07 | 0.17 | 0.52 |
| 10 | 46.51 | 36.89 | 4.31 | 0.00 | 5.31 | 36.89 | 4.31 | 0.00 | 5.31 | 36.89 | 4.31 | 0.00 | 5.31 | 0.16 | 0.25 | 0.57 |
| 11 | 34.04 | 17.28 | 16.76 | 0.00 | 0.00 | 17.28 | 16.76 | 0.00 | 0.00 | 17.28 | 16.76 | 0.00 | 0.00 | 0.13 | 0.22 | 0.54 |
| 12 | 55.88 | 16.93 | 32.18 | 0.00 | 6.77 | 16.93 | 32.18 | 0.00 | 6.77 | 16.93 | 32.18 | 0.00 | 6.77 | 0.25 | 0.33 | 0.60 |
| 13 | 46.88 | 3.63 | 43.25 | 0.00 | 0.00 | 3.63 | 43.25 | 0.00 | 0.00 | 3.63 | 43.25 | 0.00 | 0.00 | 0.21 | 0.29 | 0.57 |
| 14 | 46.04 | 15.49 | 30.55 | 0.00 | 0.00 | 15.49 | 30.55 | 0.00 | 0.00 | 15.49 | 30.55 | 0.00 | 0.00 | 0.16 | 0.25 | 0.55 |
| 15 | 49.02 | 30.88 | 18.14 | 0.00 | 0.00 | 30.88 | 18.14 | 0.00 | 0.00 | 30.88 | 18.14 | 0.00 | 0.00 | 0.11 | 0.21 | 0.53 |
| 16 | 24.31 | 20.23 | 0.00 | 0.00 | 4.08 | 20.23 | 0.00 | 0.00 | 4.08 | 20.23 | 0.00 | 0.00 | 4.08 | 0.19 | 0.28 | 0.59 |
| 17 | 46.67 | 18.34 | 28.33 | 0.00 | 0.00 | 18.34 | 28.33 | 0.00 | 0.00 | 18.34 | 28.33 | 0.00 | 0.00 | 0.15 | 0.24 | 0.55 |
| 18 | 41.24 | 4.26 | 36.98 | 0.00 | 0.00 | 4.26 | 36.98 | 0.00 | 0.00 | 4.26 | 36.98 | 0.00 | 0.00 | 0.20 | 0.28 | 0.56 |
| 19 | 29.79 | 1.89 | 27.90 | 0.00 | 0.00 | 1.89 | 27.90 | 0.00 | 0.00 | 1.89 | 27.90 | 0.00 | 0.00 | 0.21 | 0.29 | 0.57 |
| 20 | 119.73 | 75.44 | 44.29 | 0.00 | 0.00 | 75.44 | 44.29 | 0.00 | 0.00 | 75.44 | 44.29 | 0.00 | 0.00 | 0.11 | 0.21 | 0.53 |
| 21 | 62.05 | 52.88 | 0.00 | 0.00 | 9.17 | 52.88 | 0.00 | 0.00 | 9.17 | 52.88 | 0.00 | 0.00 | 9.17 | 0.17 | 0.26 | 0.58 |
| 22 | 81.44 | 53.20 | 28.24 | 0.00 | 0.00 | 53.20 | 28.24 | 0.00 | 0.00 | 53.20 | 28.24 | 0.00 | 0.00 | 0.11 | 0.20 | 0.53 |
| 23 | 44.18 | 6.02 | 38.16 | 0.00 | 0.00 | 6.02 | 38.16 | 0.00 | 0.00 | 6.02 | 38.16 | 0.00 | 0.00 | 0.20 | 0.28 | 0.56 |
| 24 | 31.15 | 4.84 | 26.31 | 0.00 | 0.00 | 4.84 | 26.31 | 0.00 | 0.00 | 4.84 | 26.31 | 0.00 | 0.00 | 0.19 | 0.28 | 0.56 |
| 25 | 22.92 | 4.84 | 18.08 | 0.00 | 0.00 | 4.84 | 18.08 | 0.00 | 0.00 | 4.84 | 18.08 | 0.00 | 0.00 | 0.18 | 0.27 | 0.56 |
| 26 | 17.69 | 4.54 | 13.15 | 0.00 | 0.00 | 4.54 | 13.15 | 0.00 | 0.00 | 4.54 | 13.15 | 0.00 | 0.00 | 0.18 | 0.26 | 0.55 |
| 27 | 129.84 | 74.85 | 54.99 | 0.00 | 0.00 | 74.85 | 54.99 | 0.00 | 0.00 | 74.85 | 54.99 | 0.00 | 0.00 | 0.12 | 0.21 | 0.54 |
| 28 | 277.04 | 152.43 | 124.61 | 0.00 | 0.00 | 152.43 | 124.61 | 0.00 | 0.00 | 152.43 | 124.61 | 0.00 | 0.00 | 0.13 | 0.22 | 0.54 |
| 29 | 26.62 | 0.05 | 26.57 | 0.00 | 0.00 | 0.05 | 26.57 | 0.00 | 0.00 | 0.05 | 26.57 | 0.00 | 0.00 | 0.22 | 0.30 | 0.57 |
| 30 | 26.18 | 0.00 | 26.18 | 0.00 | 0.00 | 0.00 | 26.18 | 0.00 | 0.00 | 0.00 | 26.18 | 0.00 | 0.00 | 0.22 | 0.30 | 0.57 |
| 31 | 23.41 | 19.11 | 0.00 | 0.00 | 4.30 | 19.11 | 0.00 | 0.00 | 4.30 | 19.11 | 0.00 | 0.00 | 4.30 | 0.20 | 0.29 | 0.59 |
| 32 | 47.38 | 33.73 | 13.65 | 0.00 | 0.00 | 33.73 | 13.65 | 0.00 | 0.00 | 33.73 | 13.65 | 0.00 | 0.00 | 0.10 | 0.19 | 0.53 |
| 33 | 18.32 | 3.18 | 15.14 | 0.00 | 0.00 | 3.18 | 15.14 | 0.00 | 0.00 | 3.18 | 15.14 | 0.00 | 0.00 | 0.19 | 0.27 | 0.56 |
| 34 | 48.85 | 9.28 | 39.57 | 0.00 | 0.00 | 9.28 | 39.57 | 0.00 | 0.00 | 9.28 | 39.57 | 0.00 | 0.00 | 0.19 | 0.27 | 0.56 |
| 35 | 23.80 | 0.84 | 22.96 | 0.00 | 0.00 | 0.84 | 22.96 | 0.00 | 0.00 | 0.84 | 22.96 | 0.00 | 0.00 | 0.21 | 0.29 | 0.57 |
| 36 | 16.65 | 0.00 | 16.65 | 0.00 | 0.00 | 0.00 | 16.65 | 0.00 | 0.00 | 0.00 | 16.65 | 0.00 | 0.00 | 0.22 | 0.30 | 0.57 |
| 37 | 81.43 | 63.81 | 17.62 | 0.00 | 0.00 | 63.81 | 17.62 | 0.00 | 0.00 | 63.81 | 17.62 | 0.00 | 0.00 | 0.09 | 0.18 | 0.52 |
| 38 | 120.81 | 93.91 | 26.90 | 0.00 | 0.00 | 93.91 | 26.90 | 0.00 | 0.00 | 93.91 | 26.90 | 0.00 | 0.00 | 0.09 | 0.18 | 0.52 |

# COMPOSITE $C_5$ AND $C_{100}$

**Subdivision:** THE CANYONS
**Calculated by:** Phil Dalrymple
**Checked by:** Blake Calvert

**Nolte Job No.:** DVB032400
**Date:** August 26, 2009

| Sub Basin | Total Area (acres) | 2 Year Runoff Coefficients | | | | 5 Year Runoff Coefficients | | | | 100 Year Runoff Coefficients | | | | Total $C_2$ | Total $C_5$ | Total $C_{100}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0.05 Open Space (acres) | 0.22 Residential (acres) | 0.66 Mixed Use (acres) | 0.89 Paved (acres) | 0.15 Open Space (acres) | 0.30 Residential (acres) | 0.68 Mixed Use (acres) | 0.90 Paved (acres) | 0.51 Open Space (acres) | 0.57 Residential (acres) | 0.79 Mixed Use (acres) | 0.96 Paved (acres) | | | |
| 39 | 66.33 | 0.38 | 65.95 | 0.00 | 0.00 | 0.38 | 65.95 | 0.00 | 0.00 | 0.38 | 65.95 | 0.00 | 0.00 | 0.22 | 0.30 | 0.57 |
| 40 | 38.80 | 0.00 | 38.80 | 0.00 | 0.00 | 0.00 | 38.80 | 0.00 | 0.00 | 0.00 | 38.80 | 0.00 | 0.00 | 0.22 | 0.30 | 0.57 |
| 41 | 12.50 | 8.58 | 3.92 | 0.00 | 0.00 | 8.58 | 3.92 | 0.00 | 0.00 | 8.58 | 3.92 | 0.00 | 0.00 | 0.10 | 0.20 | 0.53 |
| 42 | 31.45 | 27.44 | 0.00 | 0.00 | 4.01 | 27.44 | 0.00 | 0.00 | 4.01 | 27.44 | 0.00 | 0.00 | 4.01 | 0.16 | 0.25 | 0.57 |
| 43 | 38.87 | 10.78 | 28.09 | 0.00 | 0.00 | 10.78 | 28.09 | 0.00 | 0.00 | 10.78 | 28.09 | 0.00 | 0.00 | 0.17 | 0.26 | 0.55 |
| 44 | 45.59 | 12.21 | 33.38 | 0.00 | 0.00 | 12.21 | 33.38 | 0.00 | 0.00 | 12.21 | 33.38 | 0.00 | 0.00 | 0.17 | 0.26 | 0.55 |
| 45 | 65.17 | 23.73 | 41.44 | 0.00 | 0.00 | 23.73 | 41.44 | 0.00 | 0.00 | 23.73 | 41.44 | 0.00 | 0.00 | 0.16 | 0.25 | 0.55 |
| 46 | 72.48 | 19.48 | 53.00 | 0.00 | 0.00 | 19.48 | 53.00 | 0.00 | 0.00 | 19.48 | 53.00 | 0.00 | 0.00 | 0.17 | 0.26 | 0.55 |
| 47 | 37.05 | 10.03 | 27.02 | 0.00 | 0.00 | 10.03 | 27.02 | 0.00 | 0.00 | 10.03 | 27.02 | 0.00 | 0.00 | 0.17 | 0.26 | 0.55 |
| 48 | 12.22 | 2.14 | 10.08 | 0.00 | 0.00 | 2.14 | 10.08 | 0.00 | 0.00 | 2.14 | 10.08 | 0.00 | 0.00 | 0.19 | 0.27 | 0.56 |
| 49 | 31.87 | 28.00 | 0.00 | 0.00 | 3.87 | 28.00 | 0.00 | 0.00 | 3.87 | 28.00 | 0.00 | 0.00 | 3.87 | 0.15 | 0.24 | 0.56 |
| 50 | 74.44 | 70.76 | 0.00 | 0.00 | 3.68 | 70.76 | 0.00 | 0.00 | 3.68 | 70.76 | 0.00 | 0.00 | 3.68 | 0.09 | 0.19 | 0.53 |
| 51 | 129.26 | 45.22 | 84.04 | 0.00 | 0.00 | 45.22 | 84.04 | 0.00 | 0.00 | 45.22 | 84.04 | 0.00 | 0.00 | 0.16 | 0.25 | 0.55 |
| 52 | 27.15 | 24.53 | 2.62 | 0.00 | 0.00 | 24.53 | 2.62 | 0.00 | 0.00 | 24.53 | 2.62 | 0.00 | 0.00 | 0.07 | 0.16 | 0.52 |
| 53 | 124.76 | 24.83 | 38.31 | 61.62 | 0.00 | 24.83 | 38.31 | 61.62 | 0.00 | 24.83 | 38.31 | 61.62 | 0.00 | 0.40 | 0.46 | 0.67 |
| 54 | 45.18 | 19.90 | 0.00 | 25.28 | 0.00 | 19.90 | 0.00 | 25.28 | 0.00 | 19.90 | 0.00 | 25.28 | 0.00 | 0.39 | 0.45 | 0.67 |
| 55 | 22.66 | 5.62 | 0.00 | 15.04 | 2.00 | 5.62 | 0.00 | 15.04 | 2.00 | 5.62 | 0.00 | 15.04 | 2.00 | 0.53 | 0.57 | 0.74 |
| 56 | 49.92 | 35.93 | 0.00 | 11.96 | 2.03 | 35.93 | 0.00 | 11.96 | 2.03 | 35.93 | 0.00 | 11.96 | 2.03 | 0.23 | 0.31 | 0.60 |
| 57 | 33.34 | 30.18 | 0.00 | 0.00 | 3.16 | 30.18 | 0.00 | 0.00 | 3.16 | 30.18 | 0.00 | 0.00 | 3.16 | 0.13 | 0.22 | 0.55 |
| 58 | 18.75 | 14.99 | 0.00 | 0.00 | 3.76 | 14.99 | 0.00 | 0.00 | 3.76 | 14.99 | 0.00 | 0.00 | 3.76 | 0.22 | 0.30 | 0.60 |
| 59 | 172.11 | 163.64 | 0.00 | 0.00 | 8.47 | 163.64 | 0.00 | 0.00 | 8.47 | 163.64 | 0.00 | 0.00 | 8.47 | 0.09 | 0.19 | 0.53 |
| 60 | 162.97 | 78.59 | 0.00 | 78.31 | 6.07 | 78.59 | 0.00 | 78.31 | 6.07 | 78.59 | 0.00 | 78.31 | 6.07 | 0.37 | 0.43 | 0.66 |
| 61 | 51.36 | 0.00 | 0.00 | 46.95 | 4.41 | 0.00 | 0.00 | 46.95 | 4.41 | 0.00 | 0.00 | 46.95 | 4.41 | 0.68 | 0.70 | 0.80 |
| 62 | 57.77 | 37.48 | 0.00 | 14.37 | 5.92 | 37.48 | 0.00 | 14.37 | 5.92 | 37.48 | 0.00 | 14.37 | 5.92 | 0.29 | 0.36 | 0.63 |
| 63 | 2.69 | 2.69 | 0.00 | 0.00 | 0.00 | 2.69 | 0.00 | 0.00 | 0.00 | 2.69 | 0.00 | 0.00 | 0.00 | 0.05 | 0.15 | 0.51 |
| 64 | 5.40 | 5.40 | 0.00 | 0.00 | 0.00 | 5.40 | 0.00 | 0.00 | 0.00 | 5.40 | 0.00 | 0.00 | 0.00 | 0.05 | 0.15 | 0.51 |
| 65 | 14.27 | 4.32 | 0.00 | 9.95 | 0.00 | 4.32 | 0.00 | 9.95 | 0.00 | 4.32 | 0.00 | 9.95 | 0.00 | 0.48 | 0.52 | 0.71 |

# DETENTION VOLUME

**Subdivision:** The Canyons
**Calculated by:** Phil Dalrymple
**Checked by:** Blake Calvert

**NOLTE Job No.:** DVB032400
**Date:** August 26, 2009

| Sub Basin | Total Area (acres) | 2 Year Runoff Coefficients 5.00 Open Space (acres) | 27.00 Residential (acres) | 85.00 Mixed Use (acres) | 100.00 Paved (acres) | Comp Impervious | $K_{10}$ | $K_{100}$ | WQ Volume (ac-ft) | Volume 10-yr (ac-ft) | Volume 100-yr (ac-ft) | Volume Total (ac-ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 38.16 | 8.98 | 13.04 | 16.14 | 0.00 | 46.35 | 0.04 | 0.08 | 0.74 | 1.61 | 3.17 | 3.90 |
| 2 | 6.67 | 0.00 | 1.03 | 3.29 | 2.35 | 81.33 | 0.08 | 0.14 | 0.23 | 0.50 | 0.95 | 1.17 |
| 3 | 25.66 | 2.49 | 21.25 | 0.12 | 1.80 | 30.26 | 0.03 | 0.05 | 0.32 | 0.69 | 1.38 | 1.71 |
| 4 | 19.68 | 3.37 | 16.31 | 0.00 | 0.00 | 23.23 | 0.02 | 0.04 | 0.19 | 0.40 | 0.80 | 0.99 |
| 5 | 74.66 | 51.00 | 18.31 | 5.35 | 0.00 | 16.13 | 0.01 | 0.03 | 0.50 | 1.00 | 2.04 | 2.54 |
| 6 | 33.30 | 25.60 | 1.48 | 0.00 | 6.22 | 23.72 | 0.02 | 0.04 | 0.33 | 0.69 | 1.39 | 1.72 |
| 7 | 18.60 | 6.98 | 11.62 | 0.00 | 0.00 | 18.74 | 0.02 | 0.03 | 0.15 | 0.30 | 0.60 | 0.75 |
| 8 | 10.99 | 0.43 | 10.56 | 0.00 | 0.00 | 26.14 | 0.02 | 0.05 | 0.12 | 0.25 | 0.51 | 0.63 |
| 9 | 33.20 | 29.40 | 3.80 | 0.00 | 0.00 | 7.52 | 0.01 | 0.01 | 0.10 | 0.17 | 0.36 | 0.46 |
| 10 | 46.51 | 36.89 | 4.31 | 0.00 | 5.31 | 17.88 | 0.02 | 0.03 | 0.35 | 0.70 | 1.43 | 1.77 |
| 11 | 34.04 | 17.28 | 16.76 | 0.00 | 0.00 | 15.83 | 0.01 | 0.03 | 0.22 | 0.45 | 0.91 | 1.14 |
| 12 | 55.88 | 16.93 | 32.18 | 0.00 | 6.77 | 29.18 | 0.03 | 0.05 | 0.68 | 1.44 | 2.90 | 3.58 |
| 13 | 46.88 | 3.63 | 43.25 | 0.00 | 0.00 | 25.30 | 0.02 | 0.04 | 0.49 | 1.04 | 2.09 | 2.59 |
| 14 | 46.04 | 15.49 | 30.55 | 0.00 | 0.00 | 19.60 | 0.02 | 0.03 | 0.38 | 0.77 | 1.56 | 1.94 |
| 15 | 49.02 | 30.88 | 18.14 | 0.00 | 0.00 | 13.14 | 0.01 | 0.02 | 0.27 | 0.52 | 1.06 | 1.33 |
| 16 | 24.31 | 20.23 | 0.00 | 0.00 | 4.08 | 20.94 | 0.02 | 0.04 | 0.21 | 0.44 | 0.89 | 1.10 |
| 17 | 46.67 | 18.34 | 28.33 | 0.00 | 0.00 | 18.35 | 0.02 | 0.03 | 0.36 | 0.73 | 1.47 | 1.83 |
| 18 | 41.24 | 4.26 | 36.98 | 0.00 | 0.00 | 24.73 | 0.02 | 0.04 | 0.42 | 0.89 | 1.80 | 2.22 |
| 19 | 29.79 | 1.89 | 27.90 | 0.00 | 0.00 | 25.60 | 0.02 | 0.05 | 0.32 | 0.67 | 1.35 | 1.67 |
| 20 | 119.73 | 75.44 | 44.29 | 0.00 | 0.00 | 13.14 | 0.01 | 0.02 | 0.66 | 1.27 | 2.59 | 3.25 |
| 21 | 62.05 | 52.88 | 0.00 | 0.00 | 9.17 | 19.04 | 0.02 | 0.03 | 0.49 | 1.00 | 2.04 | 2.53 |
| 22 | 81.44 | 53.20 | 28.24 | 0.00 | 0.00 | 12.63 | 0.01 | 0.02 | 0.43 | 0.82 | 1.68 | 2.11 |
| 23 | 44.18 | 6.02 | 38.16 | 0.00 | 0.00 | 24.00 | 0.02 | 0.04 | 0.44 | 0.92 | 1.87 | 2.31 |
| 24 | 31.15 | 4.84 | 26.31 | 0.00 | 0.00 | 23.58 | 0.02 | 0.04 | 0.31 | 0.64 | 1.29 | 1.60 |
| 25 | 22.92 | 4.84 | 18.08 | 0.00 | 0.00 | 22.35 | 0.02 | 0.04 | 0.21 | 0.44 | 0.90 | 1.11 |
| 26 | 17.69 | 4.54 | 13.15 | 0.00 | 0.00 | 21.35 | 0.02 | 0.04 | 0.16 | 0.33 | 0.66 | 0.82 |
| 27 | 129.84 | 74.85 | 54.99 | 0.00 | 0.00 | 14.32 | 0.01 | 0.02 | 0.77 | 1.52 | 3.10 | 3.88 |
| 28 | 277.04 | 152.43 | 124.61 | 0.00 | 0.00 | 14.90 | 0.01 | 0.03 | 1.72 | 3.39 | 6.93 | 8.65 |
| 29 | 26.62 | 0.05 | 26.57 | 0.00 | 0.00 | 26.96 | 0.02 | 0.05 | 0.30 | 0.63 | 1.27 | 1.57 |
| 30 | 26.18 | 0.00 | 26.18 | 0.00 | 0.00 | 27.00 | 0.02 | 0.05 | 0.29 | 0.62 | 1.25 | 1.55 |
| 31 | 23.41 | 19.11 | 0.00 | 0.00 | 4.30 | 22.45 | 0.02 | 0.04 | 0.22 | 0.45 | 0.92 | 1.14 |
| 32 | 47.38 | 33.73 | 13.65 | 0.00 | 0.00 | 11.34 | 0.01 | 0.02 | 0.22 | 0.42 | 0.86 | 1.09 |
| 33 | 18.32 | 3.18 | 15.14 | 0.00 | 0.00 | 23.18 | 0.02 | 0.04 | 0.18 | 0.37 | 0.75 | 0.92 |
| 34 | 48.85 | 9.28 | 39.57 | 0.00 | 0.00 | 22.82 | 0.02 | 0.04 | 0.46 | 0.97 | 1.96 | 2.42 |
| 35 | 23.80 | 0.84 | 22.96 | 0.00 | 0.00 | 26.22 | 0.02 | 0.05 | 0.26 | 0.55 | 1.10 | 1.36 |
| 36 | 16.65 | 0.00 | 16.65 | 0.00 | 0.00 | 27.00 | 0.02 | 0.05 | 0.19 | 0.40 | 0.80 | 0.98 |
| 37 | 81.43 | 63.81 | 17.62 | 0.00 | 0.00 | 9.76 | 0.01 | 0.02 | 0.33 | 0.60 | 1.23 | 1.56 |
| 38 | 120.81 | 93.91 | 26.90 | 0.00 | 0.00 | 9.90 | 0.01 | 0.02 | 0.50 | 0.91 | 1.86 | 2.36 |
| 39 | 66.33 | 0.38 | 65.95 | 0.00 | 0.00 | 26.87 | 0.02 | 0.05 | 0.74 | 1.57 | 3.16 | 3.90 |
| 40 | 38.80 | 0.00 | 38.80 | 0.00 | 0.00 | 27.00 | 0.02 | 0.05 | 0.44 | 0.92 | 1.86 | 2.29 |
| 41 | 12.50 | 8.58 | 3.92 | 0.00 | 0.00 | 11.90 | 0.01 | 0.02 | 0.06 | 0.12 | 0.24 | 0.30 |
| 42 | 31.45 | 27.44 | 0.00 | 0.00 | 4.01 | 17.11 | 0.01 | 0.03 | 0.22 | 0.45 | 0.92 | 1.14 |
| 43 | 38.87 | 10.78 | 28.09 | 0.00 | 0.00 | 20.90 | 0.02 | 0.04 | 0.34 | 0.70 | 1.42 | 1.75 |
| 44 | 45.59 | 12.21 | 33.38 | 0.00 | 0.00 | 21.11 | 0.02 | 0.04 | 0.40 | 0.83 | 1.68 | 2.08 |
| 45 | 65.17 | 23.73 | 41.44 | 0.00 | 0.00 | 18.99 | 0.02 | 0.03 | 0.52 | 1.05 | 2.14 | 2.65 |
| 46 | 72.48 | 19.48 | 53.00 | 0.00 | 0.00 | 21.09 | 0.02 | 0.04 | 0.64 | 1.31 | 2.66 | 3.30 |
| 47 | 37.05 | 10.03 | 27.02 | 0.00 | 0.00 | 21.04 | 0.02 | 0.04 | 0.32 | 0.67 | 1.36 | 1.68 |
| 48 | 12.22 | 2.14 | 10.08 | 0.00 | 0.00 | 23.15 | 0.02 | 0.04 | 0.12 | 0.25 | 0.50 | 0.61 |
| 49 | 31.87 | 28.00 | 0.00 | 0.00 | 3.87 | 16.54 | 0.01 | 0.03 | 0.22 | 0.44 | 0.90 | 1.12 |
| 50 | 74.44 | 70.76 | 0.00 | 0.00 | 3.68 | 9.70 | 0.01 | 0.02 | 0.30 | 0.54 | 1.12 | 1.42 |
| 51 | 129.26 | 45.22 | 84.04 | 0.00 | 0.00 | 19.30 | 0.02 | 0.03 | 1.04 | 2.12 | 4.32 | 5.36 |
| 52 | 27.15 | 24.53 | 2.62 | 0.00 | 0.00 | 7.12 | 0.00 | 0.01 | 0.08 | 0.13 | 0.27 | 0.35 |
| 53 | 124.76 | 24.83 | 38.31 | 61.62 | 0.00 | 51.27 | 0.05 | 0.09 | 2.67 | 5.84 | 11.43 | 14.09 |
| 54 | 45.18 | 19.90 | 0.00 | 25.28 | 0.00 | 49.76 | 0.05 | 0.09 | 0.94 | 2.05 | 4.02 | 4.96 |

# DETENTION VOLUME

**Subdivision:** The Canyons
**Calculated by:** Phil Dalrymple
**Checked by:** Blake Calvert

**NOLTE Job No.:** DVB032400
**Date:** August 26, 2009

| Sub Basin | Total Area (acres) | 2 Year Runoff Coefficients 5.00 Open Space (acres) | 27.00 Residential (acres) | 85.00 Mixed Use (acres) | 100.00 Paved (acres) | Comp Impervious | $K_{10}$ | $K_{100}$ | WQ Volume (ac-ft) | Volume 10-yr (ac-ft) | Volume 100-yr (ac-ft) | Volume Total (ac-ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 55 | 22.66 | 5.62 | 0.00 | 15.04 | 2.00 | 66.48 | 0.06 | 0.12 | 0.63 | 1.39 | 2.67 | 3.30 |
| 56 | 49.92 | 35.93 | 0.00 | 11.96 | 2.03 | 28.03 | 0.02 | 0.05 | 0.58 | 1.23 | 2.48 | 3.07 |
| 57 | 33.34 | 30.18 | 0.00 | 0.00 | 3.16 | 14.00 | 0.01 | 0.02 | 0.19 | 0.38 | 0.78 | 0.97 |
| 58 | 18.75 | 14.99 | 0.00 | 0.00 | 3.76 | 24.05 | 0.02 | 0.04 | 0.19 | 0.39 | 0.79 | 0.98 |
| 59 | 172.11 | 163.64 | 0.00 | 0.00 | 8.47 | 9.68 | 0.01 | 0.01 | 0.69 | 1.25 | 2.58 | 3.27 |
| 60 | 162.97 | 78.59 | 0.00 | 78.31 | 6.07 | 46.98 | 0.04 | 0.08 | 3.19 | 6.96 | 13.70 | 16.89 |
| 61 | 51.36 | 0.00 | 0.00 | 46.95 | 4.41 | 86.29 | 0.08 | 0.15 | 1.85 | 4.11 | 7.71 | 9.56 |
| 62 | 57.77 | 37.48 | 0.00 | 14.37 | 5.92 | 34.63 | 0.03 | 0.06 | 0.83 | 1.79 | 3.57 | 4.41 |
| 63 | 2.69 | 2.69 | 0.00 | 0.00 | 0.00 | 5.00 | 0.00 | 0.01 | 0.01 | 0.01 | 0.02 | 0.02 |
| 64 | 5.40 | 5.40 | 0.00 | 0.00 | 0.00 | 5.00 | 0.00 | 0.01 | 0.01 | 0.02 | 0.03 | 0.04 |
| 65 | 14.27 | 4.32 | 0.00 | 9.95 | 0.00 | 60.78 | 0.06 | 0.11 | 0.36 | 0.80 | 1.54 | 1.90 |

# OFFSITE WATER QUALITY VOLUME

**Subdivision:** The Canyons
**Calculated by:** Phil Dalrymple
**Checked by:** Blake Calvert

**NOLTE Job No.:** DVB032400
**Date:** June 15, 2009

| Sub Basin | Total Area (acres) | 2 Year Runoff Coefficients 5.00 Open Space (acres) | 27.00 Residential (acres) | 85.00 Mixed Use (acres) | 100.00 Paved (acres) | Comp Impervious | WQ Volume (ac-ft) |
|---|---|---|---|---|---|---|---|
| OS1 | 1.71 | 1.71 | 0.00 | 0.00 | 0.00 | 5.00 | 0.00 |
| OS2 | 1.34 | 1.34 | 0.00 | 0.00 | 0.00 | 5.00 | 0.00 |
| OS3 | 13.33 | 13.33 | 0.00 | 0.00 | 0.00 | 5.00 | 0.03 |
| OS4 | 237.00 | 237.00 | 0.00 | 0.00 | 0.00 | 5.00 | 0.49 |
| OS5 | 154.35 | 154.35 | 0.00 | 0.00 | 0.00 | 5.00 | 0.32 |
| OS6 | 7.02 | 7.02 | 0.00 | 0.00 | 0.00 | 5.00 | 0.01 |
| OS7 | 12.60 | 12.60 | 0.00 | 0.00 | 0.00 | 5.00 | 0.03 |
| OS8 | 314.06 | 314.06 | 0.00 | 0.00 | 0.00 | 5.00 | 0.65 |
| OS9 | 3.21 | 3.21 | 0.00 | 0.00 | 0.00 | 5.00 | 0.01 |
| OS10 | 457.76 | 457.76 | 0.00 | 0.00 | 0.00 | 5.00 | 0.95 |
| OS11 | 0.99 | 0.99 | 0.00 | 0.00 | 0.00 | 5.00 | 0.00 |
| OS12 | 77.64 | 77.64 | 0.00 | 0.00 | 0.00 | 5.00 | 0.16 |
| OS13 | 12.60 | 12.60 | 0.00 | 0.00 | 0.00 | 5.00 | 0.03 |
| OS14 | 79.18 | 79.18 | 0.00 | 0.00 | 0.00 | 5.00 | 0.16 |
| OS15 | 1.58 | 1.58 | 0.00 | 0.00 | 0.00 | 5.00 | 0.00 |
| OS16 | 333.39 | 333.39 | 0.00 | 0.00 | 0.00 | 5.00 | 0.69 |
| OS17 | 41.47 | 41.47 | 0.00 | 0.00 | 0.00 | 5.00 | 0.09 |
| OS18 | 180.24 | 180.24 | 0.00 | 0.00 | 0.00 | 5.00 | 0.38 |
| OS19 | 404.80 | 404.80 | 0.00 | 0.00 | 0.00 | 5.00 | 0.84 |
| OS20 | 6.30 | 6.30 | 0.00 | 0.00 | 0.00 | 5.00 | 0.01 |

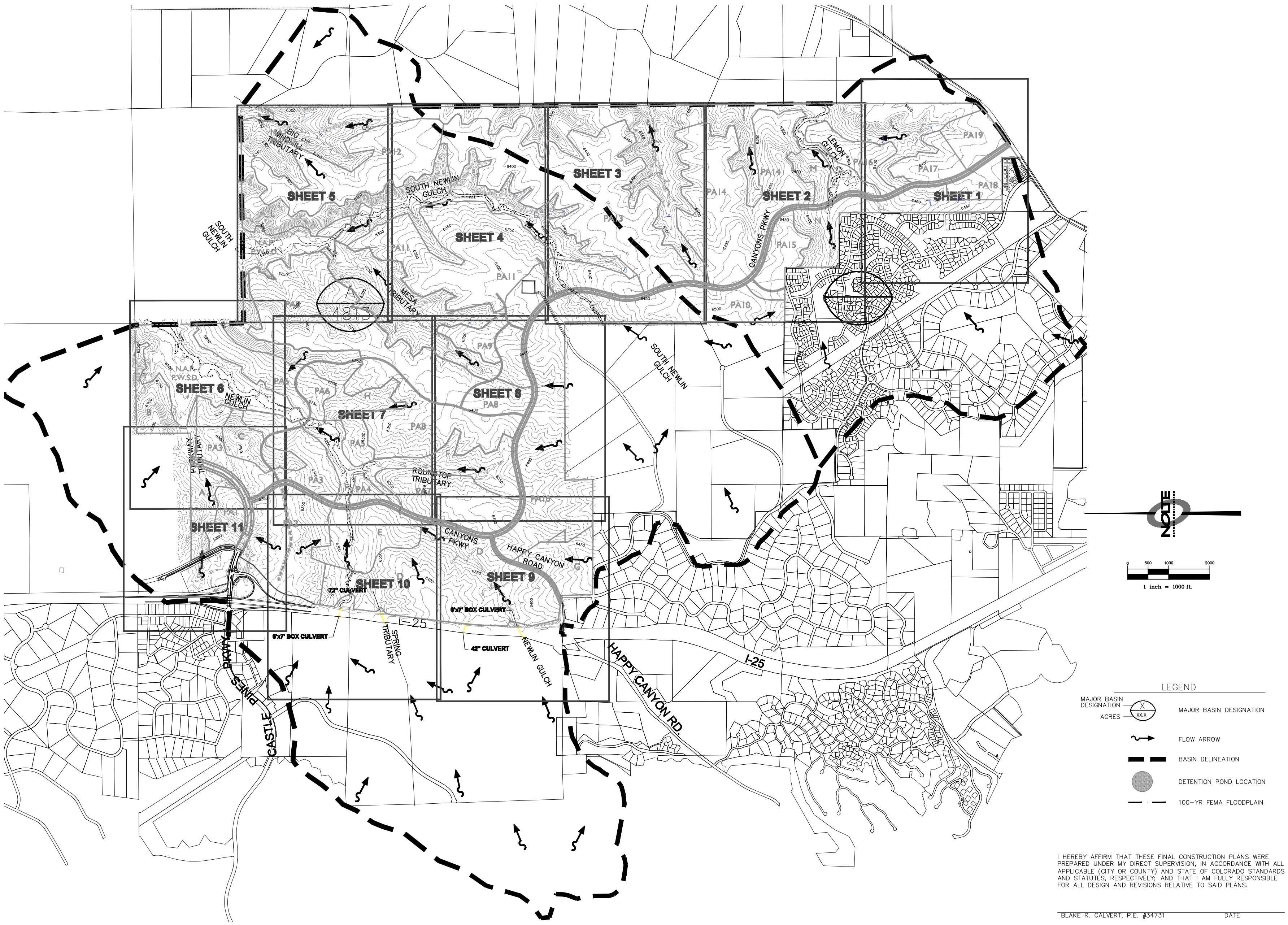
# DETENTION PONDS

**Subdivision:** The Canyons
**Calculated by:** Phil Dalrymple
**Checked by:** Blake Calvert

**NOLTE Job No.:** DVB032400
**Date:** August 26, 2009

| Pond | Contrib. Basins | Approx. Det. Volume (ac-ft) |
|---|---|---|
| 1 | 1,2 | 5.08 |
| 2 | 4 | 0.99 |
| 3 | 5,8,9,10,11,64 | 7.27 |
| 4 | 3,6 | 3.47 |
| 5 | 7 | 1.56 |
| 6 | 12,13 | 6.17 |
| 7 | 14,15 | 3.27 |
| 8 | 16,17 | 2.93 |
| 9 | 18 | 2.22 |
| 10 | 19 | 1.67 |
| 11 | 20 | 3.25 |
| 12 | 21,22 | 5.60 |
| 13 | 23 | 2.31 |
| 14 | 25 | 1.11 |
| 15 | 24 | 1.60 |
| 16 | 26 | 0.82 |
| 17 | 27,29,30,36 | 7.98 |
| 18 | 34 | 2.42 |
| 19 | 42,43 | 3.06 |
| 20 | 44 | 2.08 |
| 21 | 31,32 | 2.23 |
| 22 | 33 | 0.92 |
| 23 | 35 | 1.36 |
| 24 | 38 | 2.36 |
| 25 | 39 | 3.90 |
| 26 | 40,41 | 2.59 |
| 27 | 49,50,51 | 8.08 |
| 28 | 57,58,59,63 | 6.03 |
| 29 | 60 | 18.11 |
| 30 | 45,52,53 | 17.10 |
| 31 | 46 | 3.30 |
| 32 | 54 | 4.96 |
| 33 | 47 | 1.68 |
| 34 | 48 | 0.63 |
| 35 | 55,61,62 | 17.26 |
| 36 | 37 | 1.56 |
| 37 | 28 | 8.65 |
| 38 | 56,65 | 4.97 |

* Includes Water Quality Volume for Offsite Basins in Ponds 1, 3-6, 12, 19, 21, 27-29, 34




## LEGEND

| | |
|---|---|
| MAJOR BASIN DESIGNATION / ACRES (X, XX.X) | MAJOR BASIN DESIGNATION |
| | FLOW ARROW |
| | BASIN DELINEATION |
| | DETENTION POND LOCATION |
| | 100-YR FEMA FLOODPLAIN |

I HEREBY AFFIRM THAT THESE FINAL CONSTRUCTION PLANS WERE PREPARED UNDER MY DIRECT SUPERVISION, IN ACCORDANCE WITH ALL APPLICABLE (CITY OR COUNTY) AND STATE OF COLORADO STANDARDS AND STATUTES, RESPECTIVELY; AND THAT I AM FULLY RESPONSIBLE FOR ALL DESIGN AND REVISIONS RELATIVE TO SAID PLANS.

BLAKE R. CALVERT, P.E. #34731 DATE

| NO. | BY | DATE | REVISIONS: |
|---|---|---|---|
| | | | |

CAUTION: The engineer preparing these plans will not be responsible for, or liable for, unauthorized changes to or uses of these plans. All changes to the plans must be in writing and must be approved by the preparer of these plans.

# THE CANYONS

## GENERAL LOCATION MAP
## CASTLE PINES NORTH, COLORADO

PREPARED FOR: NORTH CANYONS, LLLP. DATE SUBMITTED: 3/9/09

NOLTE
BEYOND ENGINEERING
8000 S. Chester Street, Suite 200
Centennial, CO 80112
303.220.6400 TEL 303.220.9001 FAX
WWW.NOLTE.COM

PRELIMINARY
NOT FOR CONSTRUCTION

SHEET NUMBER 1
1 OF 1 SHEETS
JOB NUMBER DVB032400

DATE: 8/26/09 TIME: 3:46:23 PM DRAWING NAME: DRAINAGE MAP OVERALL-CPN.DWG
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XREFS: C-PD-Canyons, X-TP-CANYONSO PD, X-TP-CANYONS-Offsite2, PRDR-CPN

PRELIMINARY
NOT FOR CONSTRUCTION

NOLTE
BEYOND ENGINEERING
8008 S. Quebec Street, Suite 300
Centennial, CO 80112
303.850.4100 TEL 303.850.4101 FAX
WWW.NOLTE.COM

PREPARED FOR: NORTH CANYONS, LLLP.

DATE SUBMITTED: 09/09/2009

THE CANYONS
DRAINAGE MAP
CASTLE PINES NORTH, COLORADO

| NO. | BY | DATE | REVISIONS |
|---|---|---|---|
| | | | |

CAUTION
The engineer preparing these plans will not be responsible for, or liable for, unauthorized changes to or uses of these plans. All changes to the plans must be in writing and must be approved by the preparer of these plans.

SHEET NUMBER 1 OF 11 SHEETS
JOB NUMBER DVB032400

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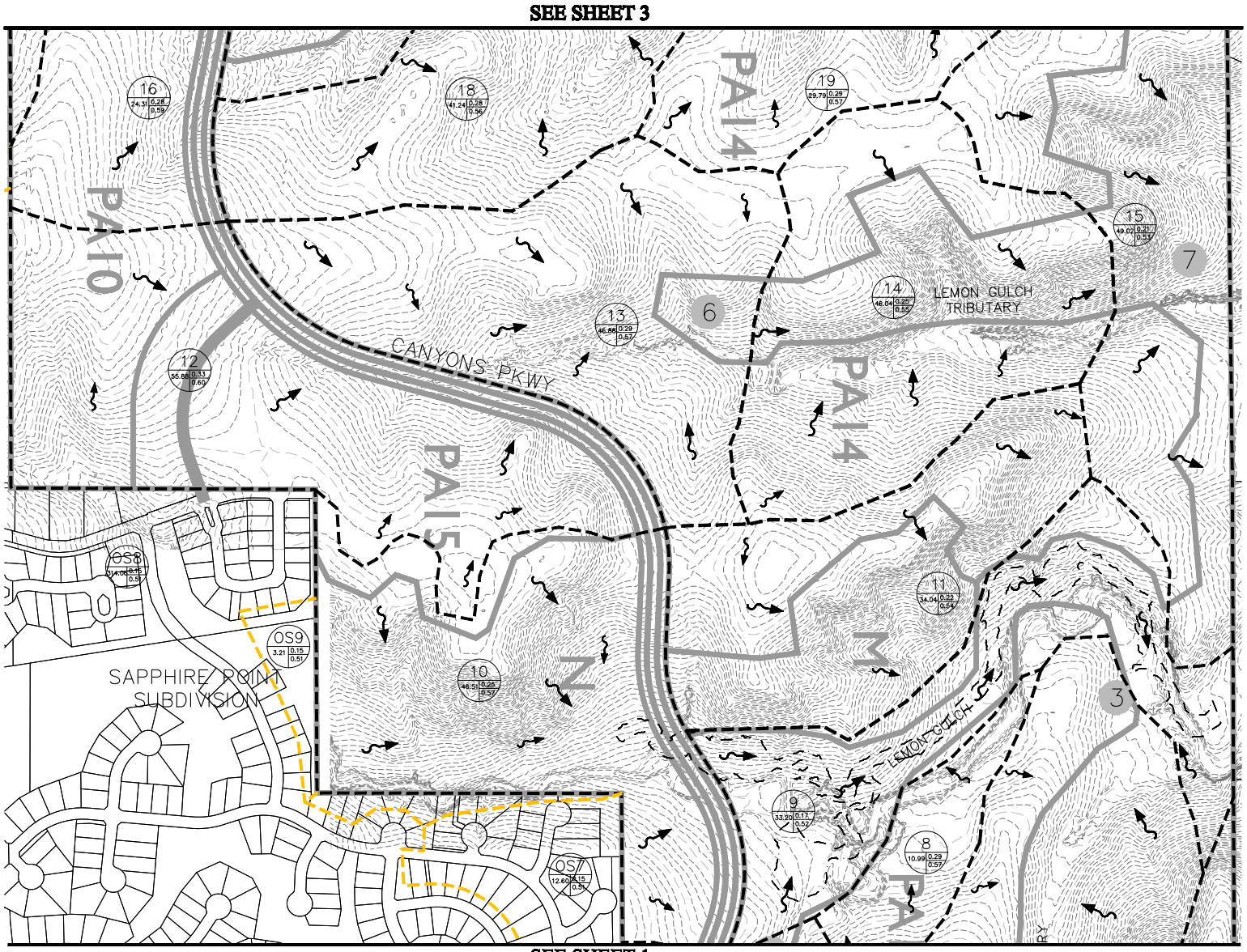
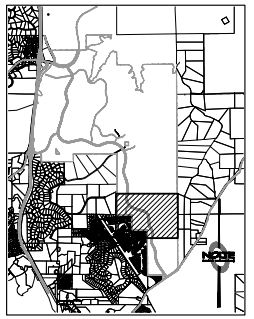
XREFS: X-TP-CANYONS-DRAIN2, C-PD-CANYONS, X-TP-CANYONS2, PROP-CPN



**LEGEND**

- 5 | 1.76 Ac. | $C_5$ / $C_{100}$ — BASIN DESIGNATION WITH ACREAGE AND $C_5$,$C_{100}$ RUNOFF VALUES
- FLOW DIRECTION ARROW
- BASIN DELINEATION
- PROPOSED POND
- 100-YR FEMA FLOODPLAIN
- **PA12** PLANNING AREA DESIGNATION

I HEREBY AFFIRM THAT THESE FINAL CONSTRUCTION PLANS WERE PREPARED UNDER MY DIRECT SUPERVISION, IN ACCORDANCE WITH ALL APPLICABLE (CITY OR COUNTY) AND STATE OF COLORADO STANDARDS AND STATUTES, RESPECTIVELY; AND THAT I AM FULLY RESPONSIBLE FOR ALL DESIGN AND REVISIONS RELATIVE TO SAID PLANS.

BLAKE R. CALVERT, P.E. #34731 DATE

# THE CANYONS
## DRAINAGE MAP
## CASTLE PINES NORTH, COLORADO

PREPARED FOR: NORTH CANYONS, L.L.L.P. DATE SUBMITTED: 03/09/2009

NO. BY DATE REVISIONS

CAUTION

The engineer accepts these plans in digital form as is and is not responsible for any unauthorized changes or uses of these plans. All changes to the plans must be in writing and must be approved by the preparer of these plans.


NOLTE
BEYOND ENGINEERING
5500 S. Quebec Street, Suite 200 Centennial, CO 80155
303.850.4400 TEL 303.850.4401 FAX WWW.NOLTE.COM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SHEET NUMBER 2
2 OF 11 SHEETS

JOB NUMBER DVB032400

DATE: 8/26/09 TIME: 3:58:19 PM DRAWING NAME: DRAINAGE MAP-CPNLOWG
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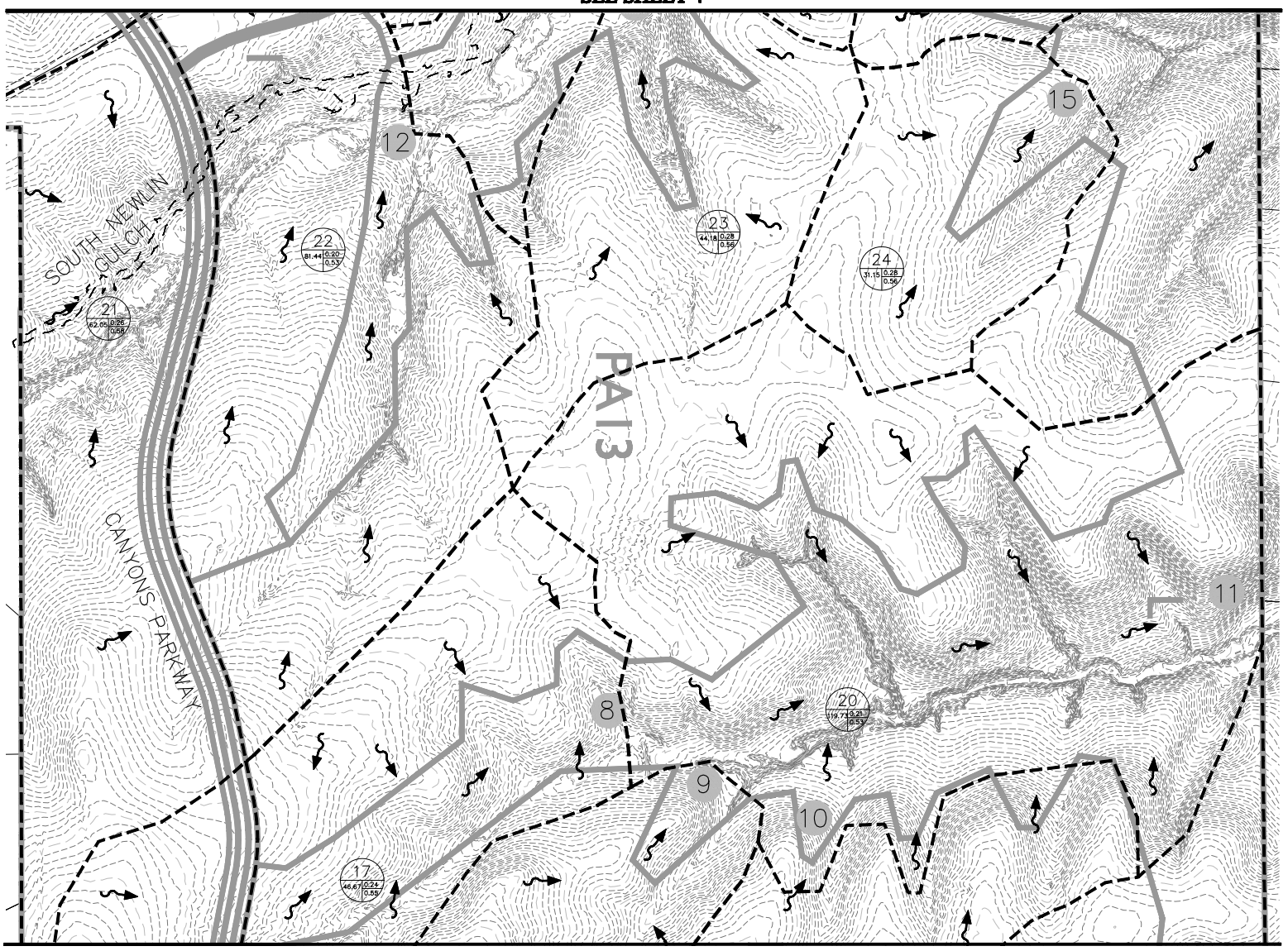


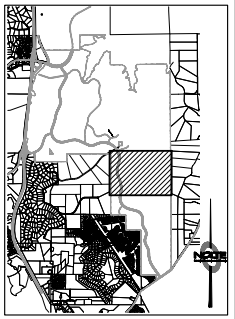

KEYMAP
SCALE: 1" = 5000'

## LEGEND

- 5 / 1.76 Ac. / $C_5$ / $C_{100}$ — BASIN DESIGNATION WITH ACREAGE AND $C_5$,$C_{100}$ RUNOFF VALUES
- FLOW DIRECTION ARROW
- BASIN DELINEATION
- PROPOSED POND
- 100-YR FEMA FLOODPLAIN
- **PA12** — PLANNING AREA DESIGNATION

I HEREBY AFFIRM THAT THESE FINAL CONSTRUCTION PLANS WERE PREPARED UNDER MY DIRECT SUPERVISION, IN ACCORDANCE WITH ALL APPLICABLE (CITY OR COUNTY) AND STATE OF COLORADO STANDARDS AND STATUTES, RESPECTIVELY; AND THAT I AM FULLY RESPONSIBLE FOR ALL DESIGN AND REVISIONS RELATIVE TO SAID PLANS.

BLAKE R. CALVERT, P.E. #34731 DATE

NO. | BY | DATE | REVISIONS

CAUTION

The engineer accepts these plans in digital form as is and is not responsible for their accuracy. Any changes to the plans must be in writing and must be approved by the preparer of these plans.

# THE CANYONS
## DRAINAGE MAP
### CASTLE PINES NORTH, COLORADO

PREPARED FOR: NORTH CANYONS, L.L.P. DATE SUBMITTED: 03/09/2009

NOLTE
BEYOND ENGINEERING
8000 S. Chester Street, Suite 200
Centennial, CO 80112
303.850.4400 TEL 303.850.4401 FAX
WWW.NOLTE.COM

PRELIMINARY
NOT FOR CONSTRUCTION

SHEET NUMBER 3
3 OF 11 SHEETS
JOB NUMBER DVB032400

DATE: 8/26/09 TIME: 3:58:13 PM DRAWING NAME: DRAINAGE MAP-CPNLOW3
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XREFS: X:\P-CANYONS-ORIGINAL-C-PD-DRAWING_X\P-CANYONS_PROB.DWG

THE CANYONS
DRAINAGE MAP
CASTLE PINES NORTH, COLORADO
PREPARED FOR: NORTH CANYONS, LLP.
DATE SUBMITTED: 09/09/2009
NOTE
BEYOND ENGINEERING
Chatfield, CO 80138
8008 S. Quebec Street, Suite 300
303.850.4400 TEL 303.850.4401 FAX
www.nolte.com
PRELIMINARY
NOT FOR CONSTRUCTION
JOB NUMBER
DVB032400
SHEET NUMBER
4
4 OF 11 SHEETS
NO. BY DATE REVISIONS
CAUTION
The engineer preparing these plans will not be responsible for, or liable for, unauthorized changes to or uses of these plans. All changes to the plans must be in writing and must be approved by the preparer of these plans.
KEYMAP
SCALE: 1" = 5000'
1 inch = 200 ft.
0
100
200
400
LEGEND
BASIN DESIGNATION WITH ACREAGE AND $C_5$-$C_{100}$RUNOFF VALUES
5
1.76 0.5 0.54
FLOW DIRECTION ARROW
BASIN DELINEATION
PROPOSED POND
100-YR FEMA FLOODPLAIN
PLANNING AREA DESIGNATION
PA12
SEE SHEET 5
SEE SHEET 3
SEE SHEET 7 & 8
SOUTH NEWLIN GULCH
PA12
PA11
PA11
I HEREBY AFFIRM THAT THESE FINAL CONSTRUCTION PLANS WERE PREPARED UNDER MY DIRECT SUPERVISION, IN ACCORDANCE WITH ALL APPLICABLE LOCAL (CITY/COUNTY) AND STATE OF COLORADO STANDARDS AND LAWS. I FURTHER CERTIFY THAT I AM A REGISTERED ENGINEER AND AM LICENSED TO PRACTICE ENGINEERING IN THE STATE OF COLORADO, AND THAT I AM RESPONSIBLE FOR ALL DESIGN AND REVISIONS RELATIVE TO SAID PLANS.
"BLAKE R. CALVERT, P.E. #34731" DATE
DATE: 9/28/09 TIME: 3:50:21 PM DRAWING NAME: DRAINAGE MAP-CPNDMD
SCALE: DESIGNER: ### PROJ. MGR: ### PLOTTED BY: DALTEMPLE
PATH: N:\DVB032\CAD\CIVIL\REPORTS\CPN\DRAINAGE REPORT\PHASE I - CPN\SHEETS
XREFS: X-TP-CANYONS-DRAIN2. C-PD-CANYONS. X-TP-CANYONS2. PROP-CPN

# THE CANYONS
## DRAINAGE MAP
## CASTLE PINES NORTH, COLORADO

PREPARED FOR: NORTH CANYONS, LLP.

DATE SUBMITTED: 09/09/2009


NOTE
BEYOND ENGINEERING
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SHEET NUMBER 5 OF 11 SHEETS

JOB NUMBER DVB032400

| NO. | BY | DATE | REVISIONS |
|---|---|---|---|
| | | | |

CAUTION
The engineer preparing these plans will not be responsible for, or liable for, unauthorized changes to or uses of these plans. All changes to the plans must be in writing and must be approved by the preparer of these plans.

KEYMAP
SCALE: 1" = 5000'







LEGEND




BASIN DESIGNATION WITH ACREAGE AND Q5=100%IMP. VALUES

FLOW DIRECTION ARROW

BASIN DELINEATION

PROPOSED POND

100-YR FEMA FLOODPLAIN

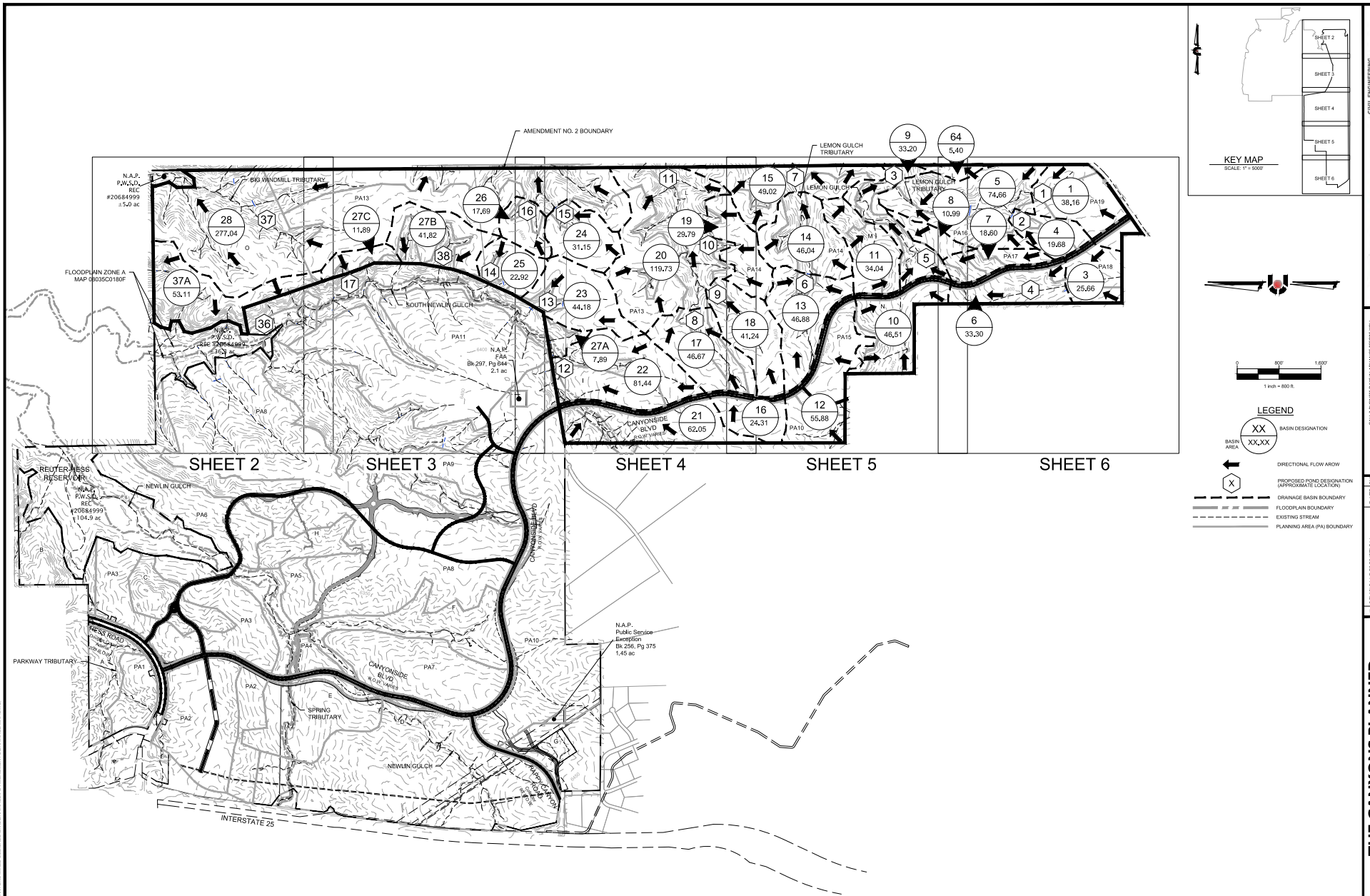
PA12 PLANNING AREA DESIGNATION

I HEREBY AFFIRM THAT THESE FINAL CONSTRUCTION PLANS WERE PREPARED UNDER MY DIRECT SUPERVISION, IN ACCORDANCE WITH ALL APPLICABLE CITY OR COUNTY AND STATE OF COLORADO STANDARDS AND LAWS IN EFFECT AT THE TIME OF SUBMITTAL, AND THAT I AM RESPONSIBLE FOR ALL DESIGN AND REVISIONS RELATIVE TO SAID PLANS.

"BLAKE R. CALVERT, P.E. #34731" DATE




DATE: 9/26/09 TIME: 3:51:59 PM DRAWING NAME: DRAINAGE MAP-CPLCMD
SCREEN: DESIGNER: #### PROJ. MGR: #### PLOTTED BY: DEPARTMENT
PATH: N:\DVB032\CAD\CIVIL\REPORTS\CPN\DRAINAGE REPORT\PHASE I - CPN\SHEETS
XREFS: X-TP-CANYONS-CPNMAP, C-PD-CANYONS, X-TP-CANYONS01_PROP-CPN

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# THE CANYONS PLANNED DEVELOPMENT 2ND AMENDMENT

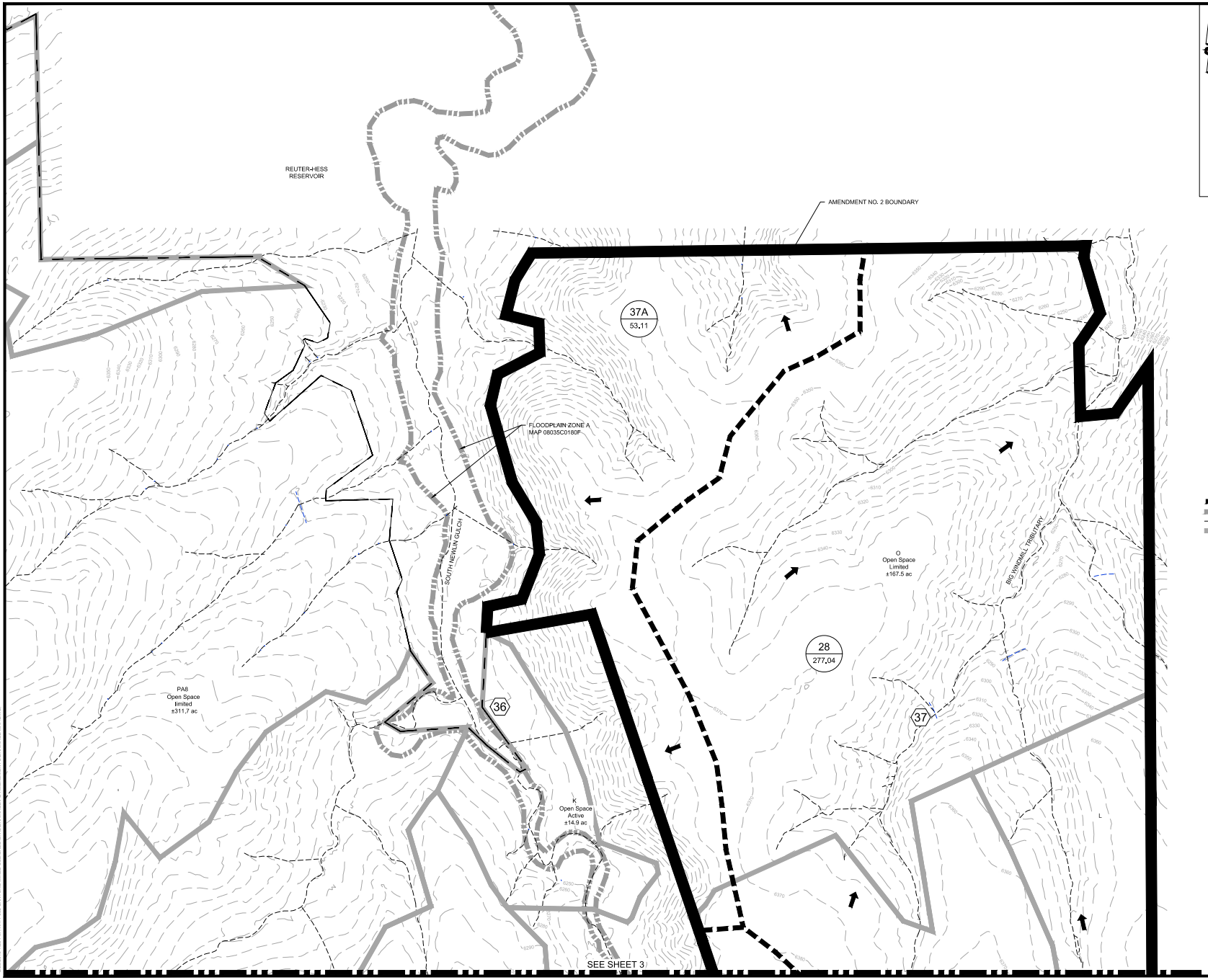
CITY OF CASTLE PINES, COLORADO
OVERALL DRAINGE MAP

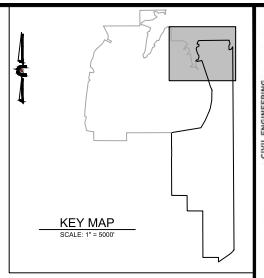
DESIGNED BY: DJB
DRAWN BY: DJB
CHECKED BY: KR

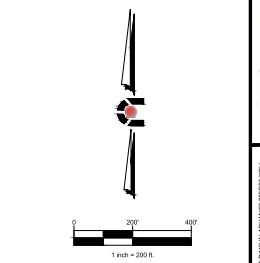
JOB NO.
14-002

SHEET
1 OF 6

5/20/2019 1:29 PM - X:\14-002 CANYONS MIXED USE\CADD\CIVIL\DRAINAGE\PD-AMENDMENT 2\DRAINAGE MAP.DWG

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COPY OF DOCUMENTS MAY BE OBTAINED FROM THE CITY LOCATIONS (HORIZONTAL AND VERTICAL) THE EXISTING UTILITIES AS SHOWN ON THESE PLANS ARE BASED ON RECORDS RECEIVED FROM THE RESPECTIVE UTILITY COMPANIES. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING THE LOCATION OF ALL UTILITIES PRIOR TO THE COMMENCEMENT OF ANY CONSTRUCTION ACTIVITIES.

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# THE CANYONS PLANNED DEVELOPMENT 2ND AMENDMENT

CITY OF CASTLE PINES, COLORADO
DETAILED DRAINGE MAP

DESIGNED BY: DJB
DRAWN BY: DJB
CHECKED BY: KR

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2 OF 6

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LEGEND

PLANNING AREA (PA) BOUNDARY
EXISTING STREAM
FLOODPLAIN BOUNDARY
DRAINAGE BASIN BOUNDARY
PROPOSED STORM DESCRIPTION (APPROXIMATE LOCATION)
DIRECTIONAL FLOW ARROW
BASIN DESIGNATION
1 inch = 200 ft

KEY MAP
SCALE: 1" = 2000'

| SHEET | JOB NO. | DESIGNED BY: | DRB |
|---|---|---|---|
| 3 OF 6 | 14-002 | DRAWN BY: | KR |
| | | CHECKED BY: | KR |

# THE CANYONS PLANNED DEVELOPMENT 2ND AMENDMENT

CITY OF CASTLE PINES, COLORADO
DETAILED DRAINGE MAP

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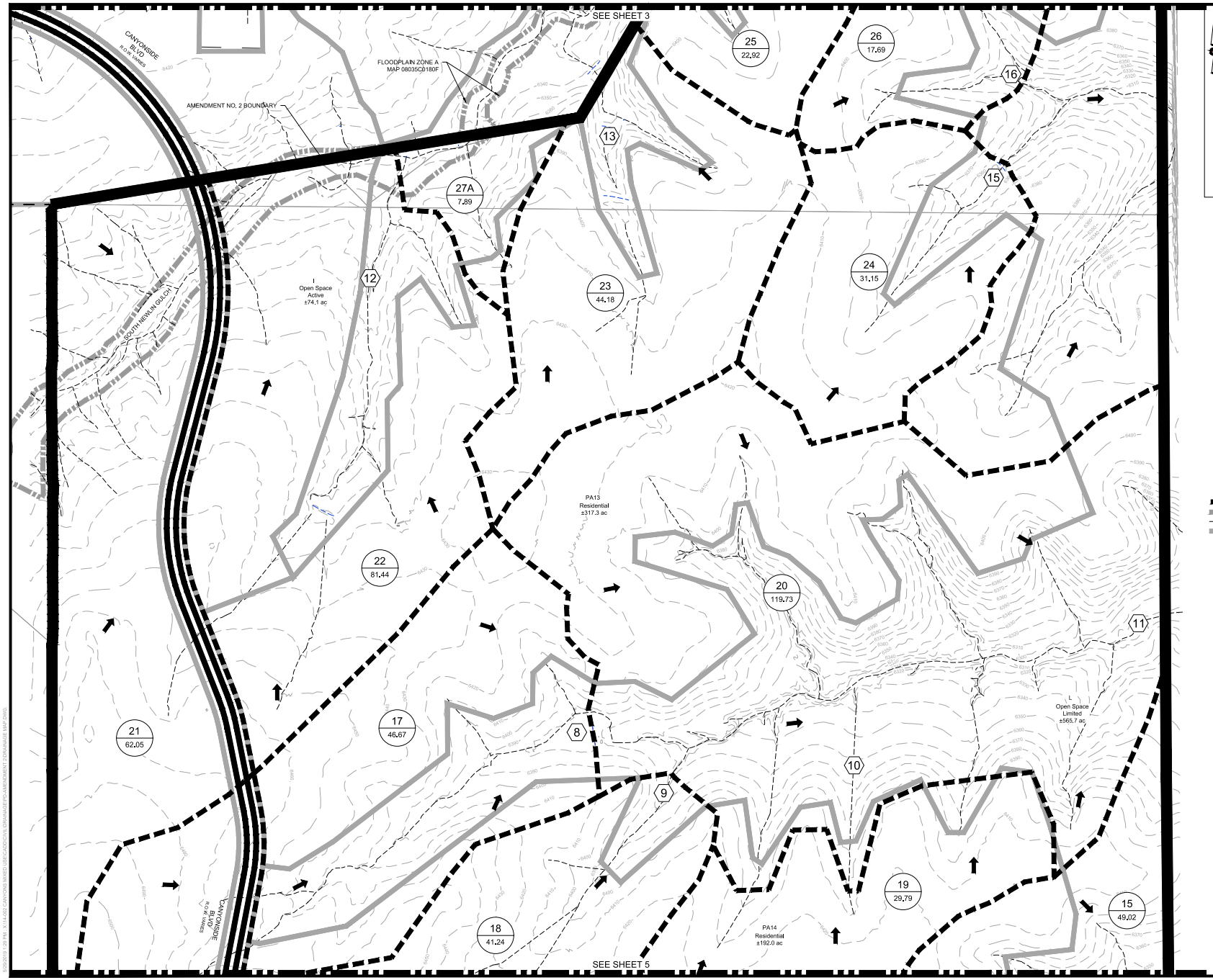


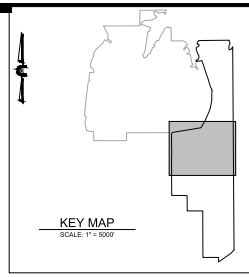


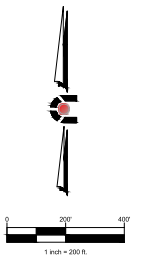


LEGEND

- XX / XX.XX — BASIN DESIGNATION (BASIN AREA)
- DIRECTIONAL FLOW AROW
- X — PROPOSED POND DESIGNATION (APPROXIMATE LOCATION)
- DRAINAGE BASIN BOUNDARY
- FLOODPLAIN BOUNDARY
- EXISTING STREAM
- PLANNING AREA (PA) BOUNDARY


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THE LOCATIONS OF EXISTING UNDERGROUND UTILITY LINES AS SHOWN ON THESE PLANS ARE BASED ON COMPANY RECORDS AND FIELD LOCATIONS. IT SHOWS THE BEST AVAILABLE INFORMATION. IT SHOWS NO RESPONSIBILITY FOR THE ACCURACY OR COMPLETENESS OF THE LOCATIONS OF ALL UTILITIES PRIOR TO THE COMMENCEMENT OF ANY CONSTRUCTION ACTIVITIES.

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# THE CANYONS PLANNED DEVELOPMENT 2ND AMENDMENT

CITY OF CASTLE PINES, COLORADO
DETAILED DRAINGE MAP

DESIGNED BY: DJB
DRAWN BY: DJB
CHECKED BY: KR

JOB NO. 14-002

SHEET 4 OF 6

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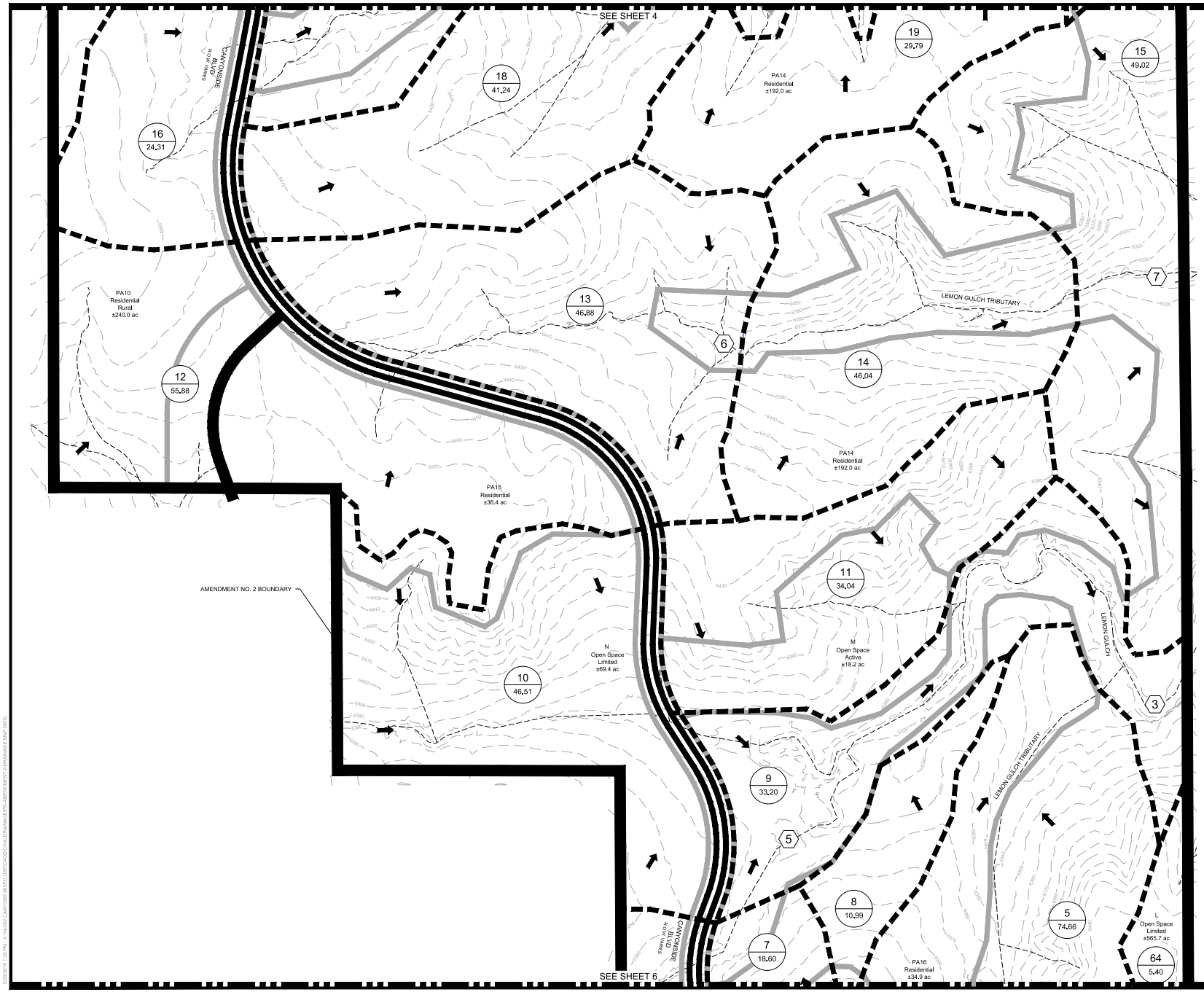


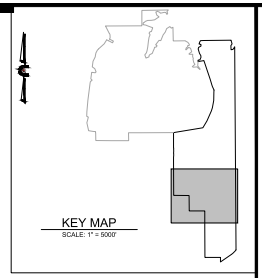


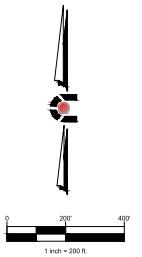


LEGEND

- XX / XX.XX — BASIN DESIGNATION / BASIN AREA
- DIRECTIONAL FLOW AROW
- X — PROPOSED POND DESIGNATION (APPROXIMATE LOCATION)
- DRAINAGE BASIN BOUNDARY
- FLOODPLAIN BOUNDARY
- EXISTING STREAM
- PLANNING AREA (PA) BOUNDARY

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# THE CANYONS PLANNED DEVELOPMENT 2ND AMENDMENT

CITY OF CASTLE PINES, COLORADO
DETAILED DRAINGE MAP

DESIGNED BY: DJB
DRAWN BY: DJB
CHECKED BY: KR

JOB NO.
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5 OF 6

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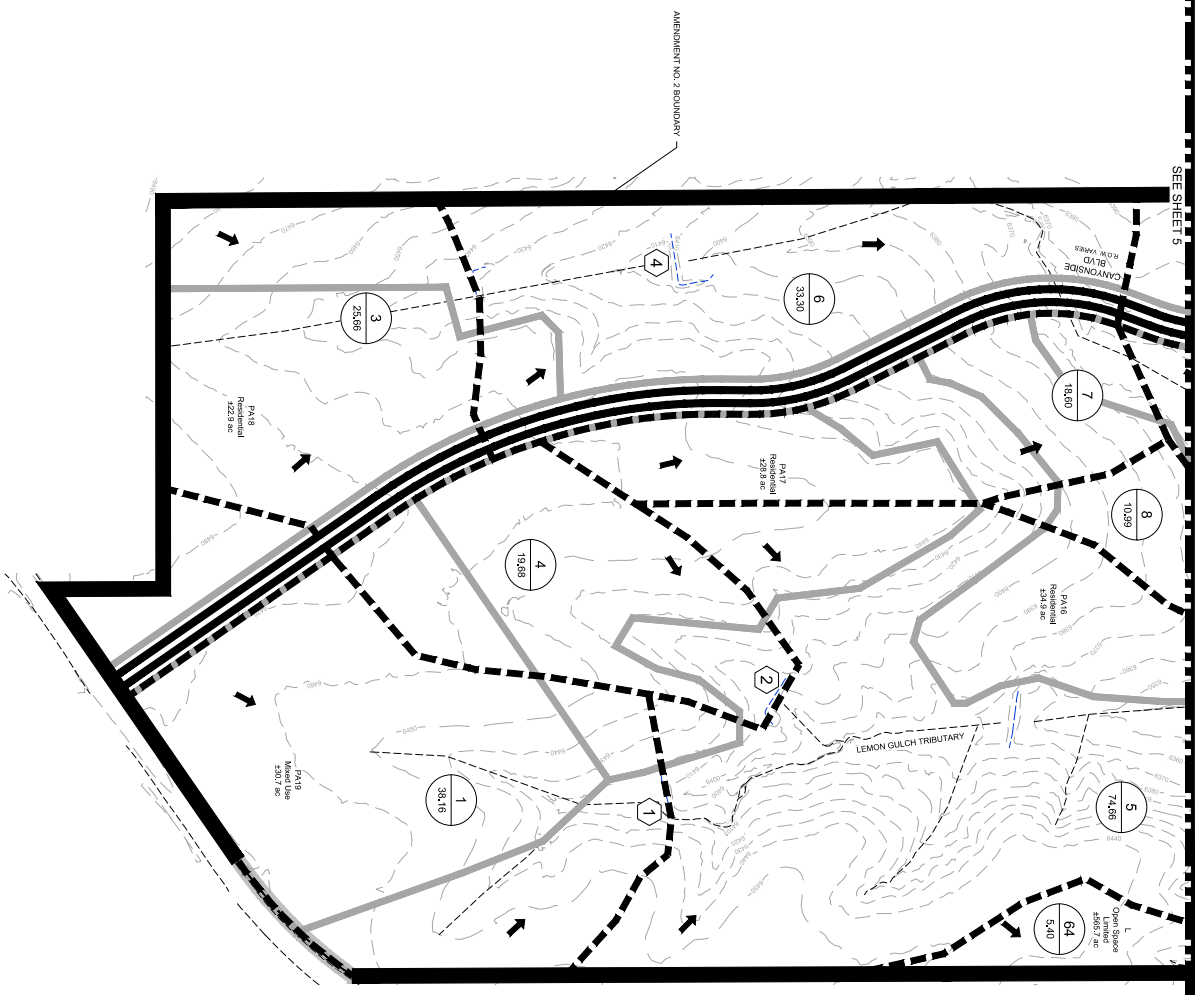


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# THE CANYONS PLANNED DEVELOPMENT 2ND AMENDMENT

CITY OF CASTLE PINES, COLORADO
DETAILED DRAINGE MAP

SHEET 6 OF 6

JOB NO. 14-002

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DRAWN BY - SSB
CHECKED BY - JKC

# APPENDIX A

VICINITY MAP
FIRM MAP 08035C0177G
FIRM MAP 08035C0180F
FIRM MAP 08035C0187G
FIRM MAP 08035C0186G
SOILS CLASSIFICATION MAP
HYDROLOGIC SOIL GROUP MAP
EXCERPTS

- Phase I Drainage Report for The Canyons – Nolte Associates, Inc. (2009)

OVERALL DRAINAGE MAP
DETAILED DRAINAGE MAPS